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Railway Age

With which are incorporated the Railway Review, the Railroad Gazette and the Railway Age-Gazette. Name Registered U. S. Patent Office.

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The new C., M., St. P. & P. dynamometer car, registering tractive force up to 250,000 lb., has unusually well appointed living quarters for its crew.

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Tells how this retarder installation expedited classification, reduced operation to two tricks and resulted in an approximate net annual saving of $153,000.

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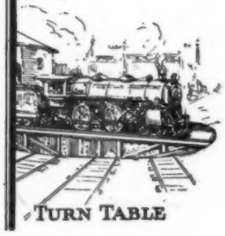
TURN TABLE

Railway Age

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A Great Passenger Terminal

IN spite of the steady decline in passenger traffic throughout the country, the railways have been and are now engaged in the construction of as many or more new great passenger terminals than in any corresponding period in their history. It is less than a year since the New York Central completed its new station at Buffalo. The Pennsylvania is making a vast expenditure for complete new facilities at Philadelphia. The railways entering Cincinnati are in the early stages of a program that will involve the ultimate expenditure of more than forty million dollars. The Illinois Central is committed to the construction of a new terminal at Chicago and the roads entering the Polk Street, La Salle Street and Grand Central terminals in the same city have been making extensive studies of new facilities for their use involving outlays of more than a hundred million dollars. Today at Cleveland a celebration is in progress to mark the completion of a passenger terminal which ranks in magnitude and completeness with the best in the country. No better demonstration can be offered of the firm conviction of the railway managements that the railway passenger train is and will continue to be the primary means of long-distance, high-speed travel and of their realization that they must provide up-to-date facilities to render adequate and efficient service.

The terminal at Cleveland is unique in many respects. In the first place, it offers an outstanding example of the newer idea of property utilization. While sacrificing no features essential to a complete railway-service unit, it superimposes over this unit an air-rights development that does much to distribute the property cost and carrying charges.

The Grand Central Terminal at New York has been and still is the outstanding example of air-rights development. In point of available ground area and high land values, its potentialities in so far as commercial utilization is concerned are far greater than those offered by any other station site in the country. The new Philadelphia terminal of the Pennsylvania probably offers the nearest approach to it, while the possibilities at Cleveland are necessarily of a much more limited scope. Nevertheless, in so far as air-rights development is concerned there is an outstanding distinction in the case of Cleveland. In no terminal developed thus far has the plan provided for such a complete reservation of floor area above street level to commercial utilization. Except for the street entrance on the Public Square, which serves also as an entrance to a large office building and the upper portion of a main concourse which extends about one story above street level, all space over the terminal area is available for commercial use from the street level. It is true that local topography favored this arrangement, but the designers of the terminal deserve credit for taking full advantage of the opportunity offered.

The article on the Cleveland project appearing in this issue refers to the construction difficulties imposed. They were many and gave rise to the exercise of a high order of engineering skill. Unlike most railway terminal projects, the builders were not concerned with the maintenance of transportation service in an existing terminal during construction, although the problem of interference with trains on considerable mileages of approach trackage was a source of no little concern.

In the main, the severest problems imposed were those of the structural engineer. Complex structural framing and heavy column loads in the buildings on the station site; a wide variety of bridges for both railway and street traffic, many of them involving limited headroom and the complications introduced by the presence of sewers, water mains and utility conduits; high retaining walls and foundation conditions that called for the exercise of judgment and initiative were important phases of the task of producing an effective transportation utility. Unfortunately for the structural engineer, much of the product of his most skillful effort is effectively concealed, once his work has been completed.

Advocates of electrification of steam railways in urban areas will no doubt cite the Cleveland project as a precedent for the incorporation of electric traction as an essential element of passenger terminal projects in other large cities. That electrification was a prerequisite to the fulfillment of the terminal plan at Cleveland is conceded. However, justification on the ground of economy of railway operation is not so clearly evidenced here since the electric operation of the trains of one of the participating lines has been confined entirely to the movement of these trains over the terminal company's property, a distance of little more than four miles. The

way is open, however, for the further expansion of electric operation at Cleveland in the event of favorable experience on the 17 miles of line now in service.

Competition in Transportation

CHAIRMAN Frank McManamy of the Interstate Commerce Commission, in an address before the Mechanical Division of the American Railway Association at Atlantic City this week, spoke optimistically about the probable future ability of the railways to meet the competition of other means of transportation. The *Railway Age* has never doubted that if the railways were entirely free to meet the competition of other means of transportation, they would be able to hold all traffic that should move by rail. Their inability within recent years to do so has been due to the fact that they have not been free to use the same competitive methods as their competitors.

The rates of the steamship lines operating between the Atlantic and Pacific coasts are not subject to regulation. They do not have to adhere to their published rates as the railways do; they can make one rate to one shipper and an entirely different rate to another shipper, which the railways are forbidden by law to do. The railways are forbidden by the Interstate Commerce Commission to make lower rates to the Pacific coast where they meet water competition than to intermediate points where they do not meet it. The railways, in other words, have lost a large amount of traffic to the steamship lines because they are not free to make their rates in the ways that are necessary to enable them to meet this competition.

Through rates made by inland waterways in connection with railway rates are published and must be observed. On the other hand, the port-to-port rates of inland waterways—in other words, those made by the water carriers independently of the railways—are not subject to regulation, and can be made whatever the water carrier finds necessary to enable it to get traffic. Independent water carriers, and even the government-owned barge line, make different rates to different shippers and otherwise practise discriminations which the railways are forbidden to practise. If the railways had the same freedom to make rates that carriers on inland waterways have, the railways would carry a much larger part of the competitive traffic, in spite of the fact that they are not subsidized by the government, while the water carriers are.

There is active competition between motor vehicle carriers on highways and the railways for both freight and passenger traffic. There is no interstate regulation of the rates of motor coach and truck lines. They make their rates in whatever way is necessary to get traffic, regardless of what discriminations may result. On the other hand, in competition with carriers by highway as well as carriers by water, the railways are obliged to publish their rates and observe them, and it is unlawful for them to make different rates to different shippers or to charge a lower rate for a longer or a shorter haul solely to meet competition.

We agree with Mr. McManamy that under fair and equal treatment of all competing means of transportation the railways would be able to retain all the traffic which should, for sound economic reasons, move by rail. We do not agree with him, if he means that they can hold all the traffic that should move by rail under the present government policies of both subsidizing competing means of transportation and regulating the rates of the railways differently from the way in which the rates of competing carriers are regulated.

Mr. McManamy intimated that some railways are showing unwisdom in investing capital in means of transportation not operated on the rails. Some mistakes probably are being made, but agencies of transportation that are being subsidized by the government and left free from such regulation of rates as is applied to the railways are, because of the aid being received, taking traffic from the railways which, on sound economic principles, should move by rail. If the government is going to continue the policy of so aiding other means of transportation as to enable them, in violation of sound economic principles, to take traffic from the railways, then we believe the railways should engage in operation on the highways, for example, in order to protect themselves from losses of traffic which otherwise will continue to occur as a result of the government's general transportation policy.

Commutation Traffic at Peak

DESPITE the business depression and the general falling off in railway business, both freight and passenger, revenue traffic statistics covering the first quarter of the year reveal the surprising fact that one class of railway traffic has not only shown an increase over the same months of 1929, but has reached a peak never before attained. This class of railway business is commutation travel.

Figures of railway commutation or suburban service were first segregated in 1922 from total passenger service. Comparing, then, commutation traffic in the first three months of 1922 with the same months of 1930, the number of passengers carried has grown from less than 109 million to almost 118 million, the number of passengers carried one mile has increased from 1,480,000,000 to 1,714,000,000, and gross passenger revenues have increased from $16,600,000 to $19,100,000. In other words, there have been in this period increases in commutation traffic of 9 per cent in the number of passengers, of 16 per cent in the number of passengers carried one mile, and of 15 per cent in gross revenues. Meanwhile railway passenger traffic aside from commutation service has shown losses of 46 per cent in the number of passengers carried, of 19 per cent in passenger-miles, and of 21 per cent in gross revenues.

The striking changes which have occurred in the last eight years are illustrated by the fact that while

in the first quarter of 1922 commutation passengers numbered 46 out of each 100 rail travelers, in the same months of 1930 they numbered 63 out of each 100 passengers. Stated somewhat differently, for every 100 passengers other than commutation carried by the steam lines in the first three months of 1922, 85 commutation passengers were carried. In the first quarter of 1930 there were 170 commuters for every 100 other rail passengers.

How Railroads Lose Business to Trucks

THERE are few large industrial concerns, in particular if they are not served by industrial tracks, which can carry on their business in these days without operating a considerable fleet of motor trucks. They have to have these trucks to transport their raw materials from the railway to the factory and to deliver finished products from the factory to the railway.

Once given a fleet of trucks to operate, the problem of operating them efficiently is bound to arise. The fleet will have to be large enough to care for peak loads. Idle truck time will naturally develop. When it does, the owner will cast about for ways and means to keep his vehicles busy during the idle time. When he does he will not be expecting an actual profit; any return which the trucks can earn in their idle time over and above the actual out-of-pocket expense of such additional operation will be a profit to the operator. For such idle time operation he need not charge interest on the investment or overhead and probably very little for depreciation and drivers' wages. The truck may thus, to a limited degree, be used for line-haul movement at an effective cost of less than half the total cost. When trucks are so used their competition with the railways becomes most serious.

Again, let us assume an agricultural area lying from 100 to 200 miles from a metropolitan consuming center. Each farmer has, say, a crate or two of vegetables or a can or two of milk for shipment each day. To make a special trip of several miles each day to and from the nearest railroad station would be a big tax on his productive time. An enterprising local individual sets up in the trucking business and calls each day for the produce of, say, a dozen farmers. After his truck is loaded in perhaps a matter of but an hour or two, what is more natural than that the truckman should himself be willing to run the load into the metropolis, even if the extra charge which he can collect will pay him little more than his added fuel, lubrication and tire expenses? The collection service, presumably, has been charged for at a rate which will cover all general expenses—taxation, depreciation and overhead—in addition to direct expenses. Anything over and above direct expenses gained from the line-haul to market, therefore, represents just that much more profit to the local truckman.

Is it not obvious, from the two common instances cited above, that the railroads in competing with the motor truck for freight are not always, as is frequently assumed, competing with a vehicle which costs upwards of 20 cents a mile to operate? Is not the effective cost of these competitive vehicles, insofar as their line-haul business is concerned, often nearer one-third the usually assumed cost?

The theory of utilization of otherwise idle time is one to which alert managers of all kinds of business have given a great deal of attention in recent years. We suspect that it may be at the bottom of much seemingly uneconomic competition of motor trucks with the railroads. If it can offer an adequate explanation for this latter phenomenon, then it makes the problem of motor truck competition even more serious and complex. It suggests as the only final solution for the problem the provision by the railroads, probably through affiliated companies, of a trucking service of such thoroughgoing nature that railway patrons will not be forced to provide themselves with trucks for any purpose at all, saving perhaps local retail delivery.

Car Retarders Save in Yard Operation

THE development and extensive application of car retarders in classification yards since the first installation in 1924, has been so rapid as to be almost phenomenal. The reason for this unusual progress lies in the ability of the retarders to facilitate yard operation and at the same time reduce operating expenses sufficiently to pay for themselves in from three to four years. The manufacturers have developed the apparatus to a high stage of mechanical perfection quickly, and the railroads have been equally active in improving their methods of yard design by grouping tracks and locating switches so as to adapt the layouts for car retarder application on a basis that proves economical.

By reason of these improvements, the retarder system has been made to meet the requirements of the local operating conditions peculiar to many yards. As a means of reducing expenses, where the operation of certain yards has at times in the past been confined to two tricks, these yards can now be operated for full three tricks, on account of the small number of men required for the operation of the retarders as compared with the number of car riders, thus eliminating delays and making more uniform the departure of trains for the adjoining divisions. On the other hand certain yards that were operated with full forces for three tricks in order to handle the business with the old methods of operation, are now operated for two split tricks, and are able not only to handle all the cars received, but do so fast enough to meet all schedules for departing trains. An example of such results is set forth in an article elsewhere in this issue describing the Pennsylvania yard at

Pitcairn, Pa. Results such as these effect large reductions in operating expenses; in the case just mentioned the saving over and above interest and depreciation is about $153,000 annually. Likewise, proportionate savings ranging from 25 to 40 per cent on the investment for new equipment are being made at other yards which have been equipped with retarders during the last year or two. When considering these facts, in addition to the ability to facilitate traffic, it is no wonder that the application of car retarders is being given consideration at numerous other yards.

Why Some Men Are Hard to Sell

IT is not the province of the *Railway Age* to tell manufacturers of railway supplies how they should sell their products. Neither can it presume to be of much assistance in training their salesmen. However, it may not be amiss to pass on some observations on the reactions which certain types of sales effort have engendered in the minds of some railway officers.

The experienced salesman studies his prospect and then endeavors to adjust his presentation so as to produce the most favorable impression on the particular individual. But some salesmen frequently fail in dealing with certain types of individuals either because they cannot grasp the prospect's point of view, or are unable to tone down an exuberant enthusiasm that has proved so highly effective in the majority of cases.

To be sold on his own product is a prime requisite for success as a salesman, but over-enthusiasm borne of this state of mind is almost fatal in dealing with a prospect possessing a scientific viewpoint, namely, the engineer whose technical training is so thoroughly ingrained that he accepts no statement unsupported and whose work causes him to deal so constantly with cold facts that he is totally without illusions. He is not looking for an ideal product that will solve all his problems. He would like to buy something that is "better," but cannot be convinced that anything is "perfect." Realizing that all things have their limitations, he likes to be told frankly what these limitations are. A statement to the effect that a certain material failed under a given stress will be received sympathetically, while a report showing that it "carried a load of 100,000 lb. without any sign of failure" leaves him cold.

It is an unfortunate fact that some men of this particular make-up are not only sceptical but actually cynical in their attitude toward the representative of the manufacturer, a state of mind which militates as much against the interests of the railroads they represent as it does against those of the manufacturer. Nevertheless, there are opportunities for improvements in the methods of presenting the merits of highly technical products to highly technical men.

The Superintendents' Minneapolis Meeting

THE convention of the Superintendents' Association at Minneapolis last week brought out considerable information of value in the promotion of efficient transportation practices. But it fell far short of its opportunities in this regard. Not only was the attendance below that which might reasonably have been expected at such a central point, but the reports, with certain outstanding exceptions, were superficial and in some cases inaccurate. Likewise, much of the time of the meeting was devoted to work of little importance, as for instance in the closing session when nearly two hours were devoted to debate over the next convention city culminating in the requirement that the members favoring the various cities pass out of the meeting room in order that they might be counted as they went through the door because of the unwillingness of the partisans of the different cities to accept either a standing count or a ballot.

No organization in the railway field has greater opportunities for service to its members and the railways. Its personnel comprises the key men in transportation production—the men who have most to do in determining the economy and efficiency with which the railways are operated. Yet its membership is far from representative of the country. As pointed out at the meeting, the representation at Minneapolis from the roads east of Chicago was negligible, while numerous important roads in other parts of the country were likewise inadequately represented. This is a reflection primarily of the lack of appeal of the program to men of experience and is an expression of the fact that they do not find sufficient information in the reports and papers to cause them to make an effort to attend.

The shortcomings of the association are in part the result of obsolete rules of procedure, a handicap which is now in the process of correction through the complete rewriting of the constitution. It is due even more, however, to the failure of many of the officers and members to take the association and its work seriously and to give to it the time necessary to prepare reports of proper thoroughness on timely problems.

In spite of the difficulties which confront this organization, it would appear that the association is headed for better days, for not a few of its members are aware of the condition and are of a mind to give more freely of their time to further its interests in order that it may assume in the transportation field a place corresponding with that of the American Railway Engineering Association in the engineering field and the Mechanical division, A.R.A., in the field of equipment.

New officers are at the helm and with the proper cooperation of the members, they can do much to strengthen the work of the association and increase its value to the railways within the next year or two.

Dedicate New Cleveland Station Today

Electrification, air-rights development and many innovations in design feature great terminal just completed

By Walter S. Lacher*
Western Engineering Editor

AS this issue of the *Railway Age* goes into the mail, the New York Central, the Big Four and the Nickel Plate are engaged in the formal dedication at Cleveland of a great passenger station which embodies many departures from general practice in passenger terminal design. Precedent, it would appear, was permitted to exert little influence in the planning of the project as a whole or of any of its essential parts. As seen from the streets of Cleveland there is little about the new station that conforms to established notions of what a great station should look like. Actually what greets the eye is a group of modern "downtown" buildings, although one of these, the Terminal Tower, is indeed a structure of impressive beauty—a landmark that can be seen from the very outskirts of the city. However, it is in this group of business buildings that we find the key to the entire terminal plan—a plan that embodies the eventual commercial utilization of every cubic foot of space that is not required for transportation purposes.

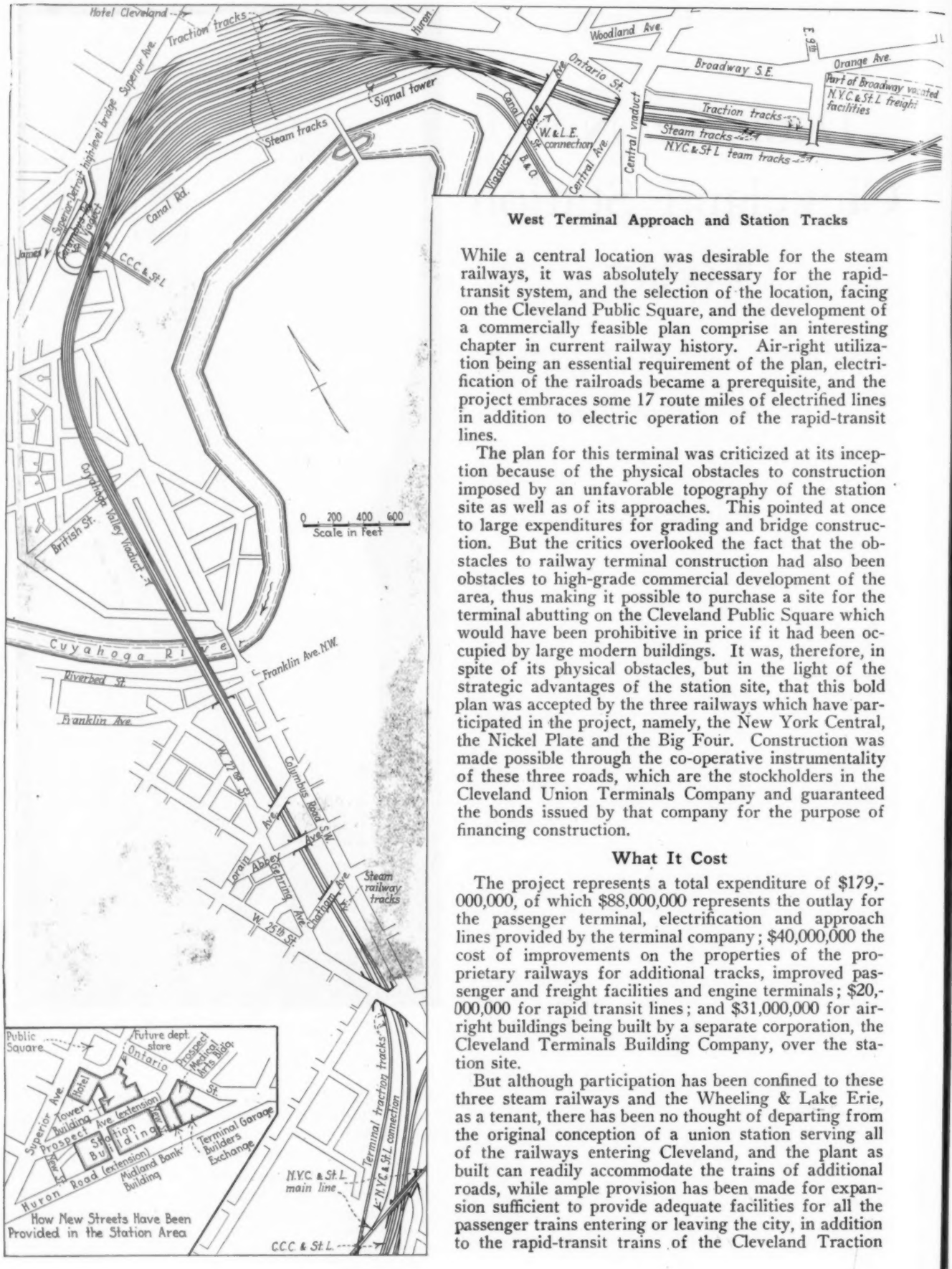
In conformity with the plan, the concourse, lobbies, waiting room and all other facilities for the accommodation of the passengers have been confined to a level below the street, but this has been done in such an ingenious way that it is not apparent to the incoming passenger until he leaves the station. While ceiling heights are less than those provided in the great cathedral-like halls of certain other large terminals, the interior of the Cleveland terminal is of generous proportions with its well-planned facilities of ample capacity for the service to be rendered. But even in the planning of the passenger facilities the effort to obtain maximum commercial utilization has found expression in the adaptation of surplus areas for concessions. In fact, the amount of space devoted to arcade shops is a distinctive feature of the terminal.

The Terminal Tower and Station Entrance as Seen Across the Public Square

A Bold Plan

These primary characteristics of the Cleveland terminal are all essential elements for the success of a plan to provide the participating railways with a commodious passenger station and create a sorely needed rapid-transit system for the city and certain of its suburbs.

* The section devoted to the electrification was prepared by A. G. Oehler, electrical editor, and the section describing the interlocking, communication facilities, etc., by J. H. Dunn, signaling editor.



West Terminal Approach and Station Tracks

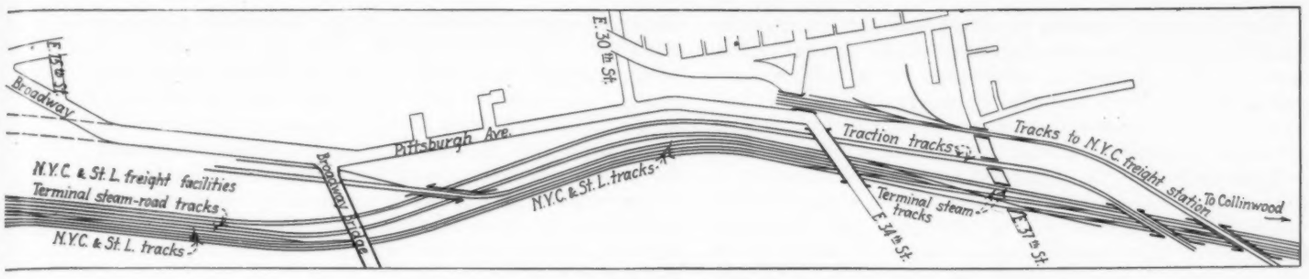
While a central location was desirable for the steam railways, it was absolutely necessary for the rapid-transit system, and the selection of the location, facing on the Cleveland Public Square, and the development of a commercially feasible plan comprise an interesting chapter in current railway history. Air-right utilization being an essential requirement of the plan, electrification of the railroads became a prerequisite, and the project embraces some 17 route miles of electrified lines in addition to electric operation of the rapid-transit lines.

The plan for this terminal was criticized at its inception because of the physical obstacles to construction imposed by an unfavorable topography of the station site as well as of its approaches. This pointed at once to large expenditures for grading and bridge construction. But the critics overlooked the fact that the obstacles to railway terminal construction had also been obstacles to high-grade commercial development of the area, thus making it possible to purchase a site for the terminal abutting on the Cleveland Public Square which would have been prohibitive in price if it had been occupied by large modern buildings. It was, therefore, in spite of its physical obstacles, but in the light of the strategic advantages of the station site, that this bold plan was accepted by the three railways which have participated in the project, namely, the New York Central, the Nickel Plate and the Big Four. Construction was made possible through the co-operative instrumentality of these three roads, which are the stockholders in the Cleveland Union Terminals Company and guaranteed the bonds issued by that company for the purpose of financing construction.

What It Cost

The project represents a total expenditure of $179,000,000, of which $88,000,000 represents the outlay for the passenger terminal, electrification and approach lines provided by the terminal company; $40,000,000 the cost of improvements on the properties of the proprietary railways for additional tracks, improved passenger and freight facilities and engine terminals; $20,000,000 for rapid transit lines; and $31,000,000 for air-right buildings being built by a separate corporation, the Cleveland Terminals Building Company, over the station site.

But although participation has been confined to these three steam railways and the Wheeling & Lake Erie, as a tenant, there has been no thought of departing from the original conception of a union station serving all of the railways entering Cleveland, and the plant as built can readily accommodate the trains of additional roads, while ample provision has been made for expansion sufficient to provide adequate facilities for all the passenger trains entering or leaving the city, in addition to the rapid-transit trains of the Cleveland Traction



East Terminal Approach

Terminals Company, which has entered into an agreement to use the new terminal facilities.

To appreciate the strategy of this project and to understand the engineering problems involved in its execution, it is necessary to have some understanding of the physical geography of Cleveland and of the railway geography of the Cleveland terminal area as a result of the physical influences exerted on railway development.

Cleveland's Business Center

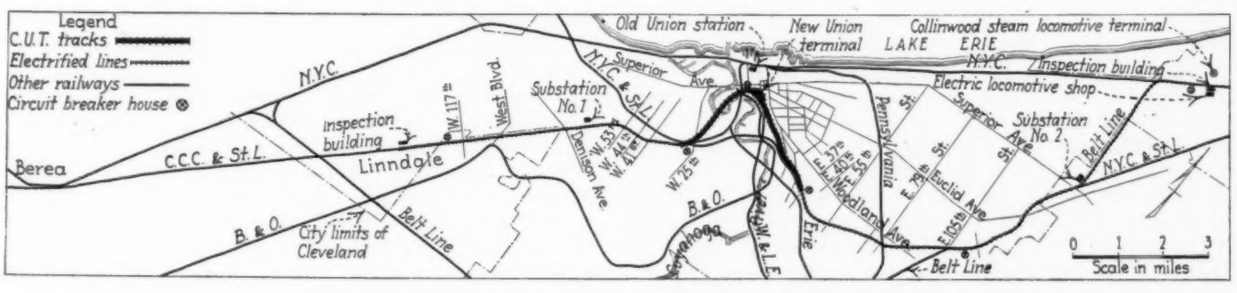
The business center of Cleveland lies approximately 90 ft. above Lake Erie on relatively level ground, which breaks off abruptly along the lake shore and on the two sides of the valley of the Cuyahoga river, that enters Lake Erie about a half mile west of the Cleveland Public Square. Near the mouth of the river the valley is not more than a quarter of a mile wide, but just south of the Square the river occupies a broad low-level basin more than a mile and a half wide. The valley of this stream and its tributaries from the east, south and west, and a narrow strip of low land next to the lake offered the most convenient means of access to the city when the railroads were originally constructed.

The establishment of the local passenger and freight terminals of the various roads was predicated primarily upon the location of their lines of approach to the city. Thus, the New York Central, the Big Four and the Pennsylvania established a passenger station on the lake front at the foot of West Ninth street on the main line of the New York Central which follows the lake front throughout practically the entire length of the city. The Big Four enters the city from the west, a mile or more south of the New York Central, and reaches the old Union depot by descending the Cuyahoga valley to its mouth. The Pennsylvania approaches the city from the south and crosses a highly developed business and residential section about two miles east of the business center to reach the lake front. All of the other railroads have passenger stations as well as freight terminals in or adjacent to the Cuyahoga River valley. The Nickel Plate crosses the city from east to west about two miles inland from the lake, while the Wheeling & Lake Erie, the Erie, and the Baltimore & Ohio follow the Cuyahoga valley for considerable distances from the south to reach their terminals.

The primary commercial development of Cleveland originally focused in the area between the Cuyahoga river and the Public Square, the center towards which the main traffic lanes from the east and southeast portions of the city converge to join Superior avenue, which is the only through traffic way that affords access to the business district from the west side of the Cuyahoga valley. Expansion from this original business center has been confined in recent years to a rather narrow zone following eastwardly along the general direction of Euclid avenue, with a resultant enhancement of land values. There has been little increase in values, on the other hand, in much of the area between Ontario street and the Cuyahoga river and a pronounced lag, if not an actual depreciation in values, in the triangle bounded by Superior avenue, Ontario street and Canal road. Although one corner of this area fronts on the Square, it had been unable to overcome the disadvantages attending a sharp slope to the river flats on the south and the absence of continuous through streets. It was occupied largely by buildings of rapidly decreasing utility.

A New Street Plan

This was the site selected for the new passenger terminal. It was felt that the primary obstacle to its commercial development could be overcome by a recasting of the street plan, in conformity with the enabling ordinance passed by the Cleveland city council, involving primarily the extension of Prospect avenue and Huron road westwardly across it to a connection with Superior avenue, and by placing this new street system on viaducts substantially on a level with Superior avenue and Ontario street. The problem of its use as a station site was a difficult one because it was necessary to develop satisfactory approaches connecting the railways in the valley with a station located at a high level. Of even more serious import was the problem of making the station accessible for the trains of the heaviest passenger-carrying railway, the New York Central.



How the Trains of the Various Roads Reach the Station

There were, of course, good reasons for locating the station at as high an elevation as possible. Chief among these is the commercial advantage of a station substantially on a level with the streets in the business district. Other considerations arose from the problems of developing suitable railway approaches to the station. A high-level plan also afforded an effective solution of the problem of crossing the river south of the station without the necessity for a movable span for river navigation. However, the development of the site for the station and provision for the approaches according to the adopted plan proved expensive. A large amount of improved property was incorporated within the necessary right-of-way, and whole blocks of business, industrial and residence buildings had to be razed to make room for the station and approach tracks.

The establishment of locations for the approaches was contingent primarily on the development of plans for the moving of trains of the three roads participating in the project, but was influenced also by the requirements for suitable connections for the lines of the other railways as prospective tenants. A primary problem was the development of a feasible means of access for the New York Central. As carried out the approach for this road from the east embraces the use of the New York Central Belt Line from Collinwood, seven miles east of Cleveland, to Superior avenue, thence over the jointly developed rights-of-way of the Belt Line and the Nickel Plate to East One Hundred and Fifth street and the remaining distance to the east end of the terminal company's approach line, via the Nickel Plate. From the west the New York Central reaches the terminal via the Big Four from a connection at Berea.

Since Cleveland is a way station for most of the passenger trains to be accommodated, a station of the through type was imperative. To meet this it was necessary to provide two approaches, one following the east side of the valley to a connection with the Nickel Plate at East Thirty-Seventh street and the other crossing the north end of the valley on a high viaduct and continuing through a shoulder in the bluffs on the west side of the valley to West Twenty-Fifth street, where the Big Four and the Nickel Plate enter Walworth run from the west. These two approaches, together with the station proper, have an aggregate length of three and one-half miles and comprise property of the Union Terminals Company and were constructed by it. But the development of the approach routes outside the limits of the terminal property involved extensive improvements in the way of additional trackage, grade separation, etc., carried out by the Big Four, the Nickel Plate and the New York Central within the limits of their own rights-of-way (about 17 miles of main line) except that the work between Collinwood and East One Hundred and Fifth street was planned and directed by the engineering department of the Terminals Company.

The new station is of the through, two-level type with all tracks on a lower level and waiting rooms, baggage, mail, express and other facilities on an upper level. However, with the exception of the street entrances and the clerestory of the principal concourse, the station facilities are all below the street level. The arrangement can best be explained by comparing the elevations of the various units with the elevations of the streets. The extensions of Huron road and Prospect avenue are at Elevation 100 where they pass over the station concourse, while the street level at the Public Square is at Elevation 85. The floors of the concourse, ticket lobby and all other station facilities, except the tracks, are at Elevation 72.5 or slightly higher. Thus, the lobby or concourse floor is only 12.5 ft. below the main entrance on the Square, but 27.5 ft. below the level of the streets which cross over these facilities, so there is ample headroom for minimum ceiling heights. The track platforms are at Elevation 52.67, or 19.83 ft. below the concourse floor level.

Looking East Over the Station Facilities Between Prospect Avenue (left) and Huron Road. Midland Bank Building in the Background, Driveway to Taxicab Stand and Baggage Room in the Foreground

Occupies Little Street Frontage

Thus, it is seen that the station plan imposes no restriction on the use of any space within the station area above the street level for other than station use, except for such street frontage and headroom as are necessary for adequate entrances to the station facilities. Provision for a main entrance has been effected in a way that provides the desired architectural emphasis, insures adequate means of access and egress and also avoids interference with the utilization of the street frontage for other purposes, namely, that of the entrance to a modern office building.

This was accomplished by selecting the southwest corner of the Public Square as the location of the dominant mass for the architectural motif, namely, a 52-story office building with a 708-ft. tower that has a frontage of 160 ft. on an east and west line formed

by cutting off the corner of the Square where the southeast and southwest sides intersect. This east and west frontage is flanked by short wings extending along the two sides of the Square.

The architectural treatment of the tower building is such as to blend effectively with that of the Hotel Cleveland erected some 12 years ago at the corner of Superior avenue and the southwest side of the Square. Plans are now being prepared for a department store building to be built continuous with the east wing of the tower building and extending to Ontario street. This will effectively balance the hotel structure adjacent to the west wing, thereby providing a substantially symmetrical V-shaped facade dominated by the tall shaft of the Terminal Tower.

Other Air-Right Structures

The external aspect of the terminal, as seen from the south and west, will be subject to change with the prosecution of air-right development. In its present stage this is confined, in addition to the structures described before, to the block bounded by Ontario street, Prospect avenue, Huron road and a new cross street, but the improvements in this one block are clearly representative of intensive utilization, embodying a massed group of buildings known as the Midland Bank, Medical Arts, Builders Exchange and Terminal Garage buildings, of a uniform height of 18 stories but of slightly varying architectural treatment.

The station has been designed to accommodate two distinct classes of service—that provided by the passenger trains of the steam lines and the rapid-transit service of the Cleveland Traction Terminals Company. And as these two types of service have almost nothing in common, the design was predicated on the principle that every effort should be made to segregate the facilities provided for each. To this end, separate trackage was provided for them, both in the station and on the approaches, the traction tracks being placed on the outer side of the "V" comprising the station property and the steam tracks on the inner side. Thus, at the station, there will eventually be 10 tracks for traction service located in the area closest to the Square, while south of these tracks there have been constructed 12 tracks for the use of steam trains with provision for 12 more. In the facilities on the station floor above the tracks, this segregation has also been carried out, as will be observed in the following description.

A Symmetrical Plan

The main axis of the station lies north and south, or at right angles with the tracks. This axis, also, is coincident with the axis of the Tower Building, and the main entrance to the station from the Square is symmetrical about this common axis. The entrance consists of five arched doorways, 18 ft. wide by 36 ft. high, which open into a portico or entrance lobby, 152 ft. long (east and west) and 34 ft. wide (north and south), that is by all odds the most beautiful room in the building. The walls, to the spring line of a barrel vault ceiling, are finished in Botticino marble laid up in a regular coursed ashlar pattern and set off by shallow pilasters and a simple entablature. The arched ceiling, with its crown 46 ft. 8 in. above the floor, is finished in octagonal coffers decorated in rose, gold and blue over an ivory base. The barrel vault is pierced on both sides by transverse arches, those on the north looking out through the arches over the doorways and the corresponding arches on the opposite side forming semicircular panels which are occupied by murals painted by Jules Guerin, under whose direction the interior decoration was carried out by the W. P. Nelson Co.

In the south wall, opposite the street entrances, are five openings, of which the three in the center lead into a second lobby that serves as the entrance foyer to the Terminal Tower office building elevators, while the two end openings serve as the main entrances to the steam road facilities of the station. At each end of the portico are openings into what are known as the traction lobbies, which also have entrances from the street. These traction lobbies are the main entrances to the rapid transit facilities of the station. Thus, there are four main entrances to the station facilities, each of which opens into an enclosed ramp about 18 ft. wide descending to the south on a 10 per cent grade to the level of the station floor.

Steam and Traction Facilities Segregated

The two ramps to the steam road facilities, which are spaced 116 ft. center to center, open into what is virtually one room, 450 ft. long, north and south, and ranging from 91 ft. to 154 ft. in width. This space is divided into three units, an "entrance lobby" at the foot of the ramps, 154 ft. wide by 75 ft. deep, a "ticket lobby" 91 ft. wide by 138 ft. long, and the "steam concourse" 120 ft. wide by 237 ft. long. The first two units have a groined ceiling, 20 ft. 6 in. above the floor, supported on columns at a uniform spacing, which also carry the superstructure of the Tower building and the extension of Prospect avenue. But the steam concourse, which occupies the block between the extensions of Prospect avenue and Huron road, is not restricted as to headroom and has a segmental arch ceiling with the spring line 38 ft. and the crown 42½ ft. above the floor. This room is unobstructed by columns; in fact, the floor is entirely clear except for the heads of the stairways leading to the track platforms at six locations on the north and south center line.

The two traction ramps are located 66 ft. to either side of the steam road ramps and communicate with separate flanking concourses 280 ft. long and 62 ft. wide, that are entirely independent of the steam road space, except for cross passages immediately to the north and south of the ticket lobby. Communication between the traction concourses and the track level is afforded by stairways, some of which open into the concourses through doors in the side walls, while others are placed in the centers of the concourses, as in the steam concourse.

Large Areas for Concessions

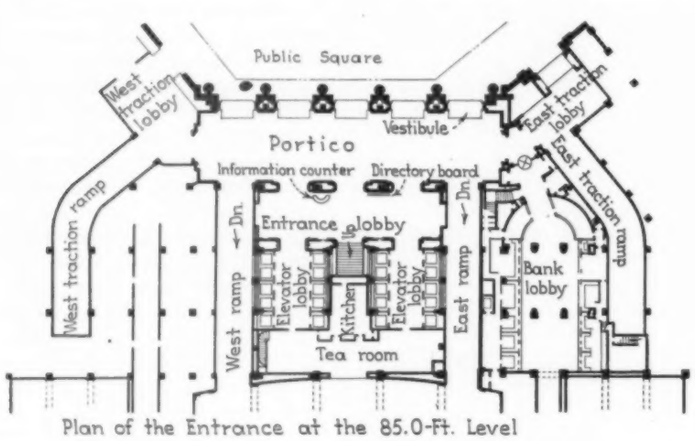
It will be observed, upon reference to the floor plans, that the layout provides ample wall frontage on the public space for all the necessary auxiliary accommodations for passengers—the ticket office on the west side of the ticket concourse, the waiting room on the west side and the lunch room, barber shop and men's toilets on the east side of the steam concourse, and the dining room, parcel checking, telephone service, baggage counter and taxicab entrance all tributary to the

south transverse passage. But even with a generous allocation of space to these various facilities, much wall frontage remained, and this has been utilized for an unusually complete development of retail shops. In fact, all available wall space in the traction concourses, the entrance lobby and the east side of the ticket lobby is occupied by the show windows of shops.

This utilization has had its influence on the architectural treatment of the lobbies, which have Tennessee marble floors, Botticino marble in the walls, and plaster ceilings. So much of the wall areas is occupied by plate glass that the heavy cast-bronze frames are a dominating feature of the design.

An Attractive Ticket Counter

The treatment of the ticket counter is particularly effective. Instead of the usual metal framework completely enclosing the glass and grill areas, the only metal work above the counters consists of the bronze frames enclosing the grilles at each ticket window, the space between windows being occupied by single panes of heavy plate glass with no molding or frame at the top.



Plan of the Entrance at the 85.0-Ft. Level

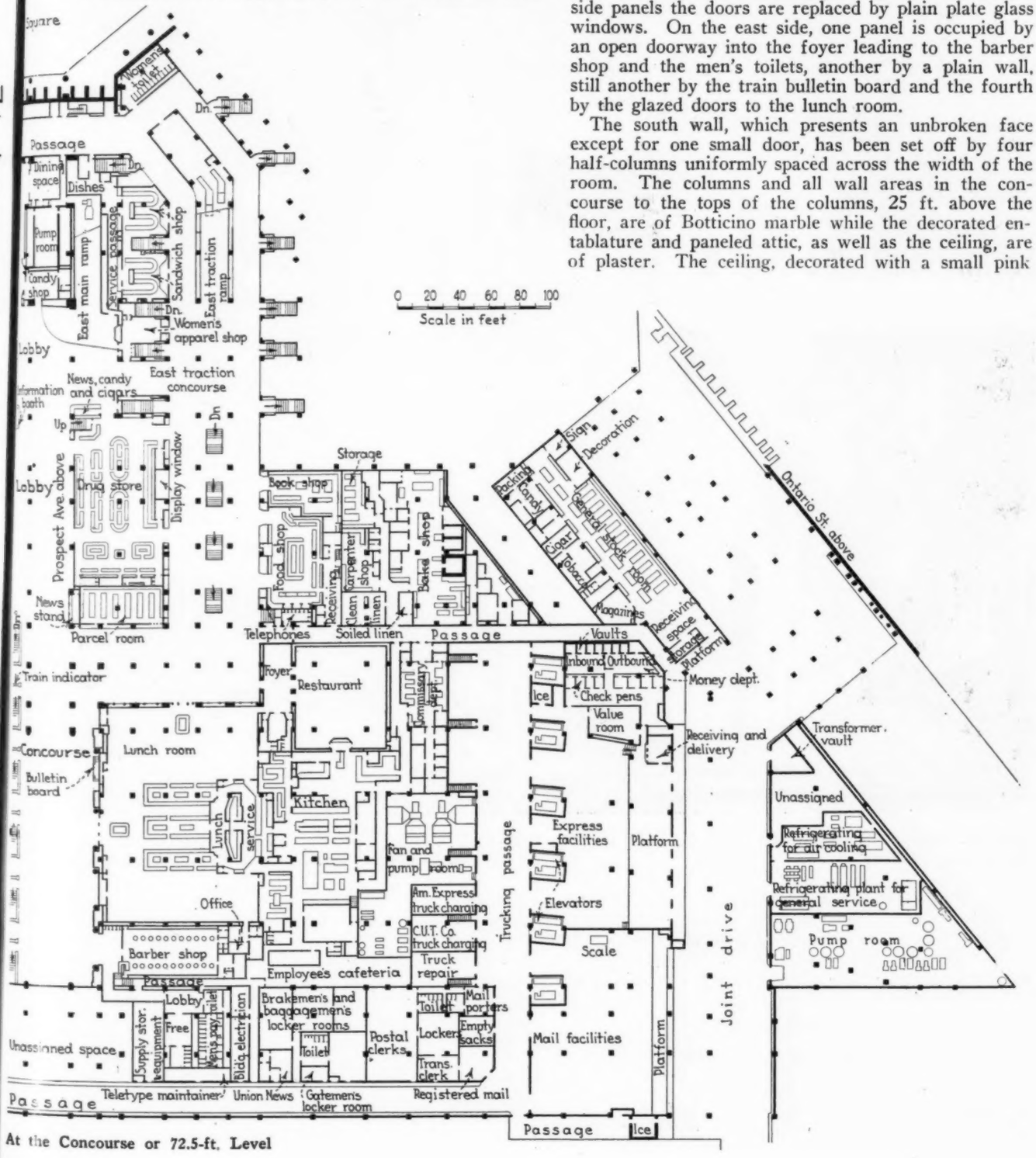
Floor Plan of the Station

A distinctive feature of the ticket office is a "travel bureau" fronting on the lobby adjacent to the ticket agent's office. This is provided for the accommodation of patrons seeking to make extended tours, who are directed to it from the ticket windows, thereby affording the passenger opportunity to obtain the desired information in a more comfortable and leisurely manner and avoiding possible congestion at the ticket windows.

The greater headroom in the steam concourse afforded increased opportunity for architectural effect. The treatment of the east and west walls was designed to meet the requirements for suitable entrances to the adjoining facilities, namely, the waiting room on the west and the lunch room and barber shop on the east. Accordingly, each wall is divided into four equal panels set off by deep pilasters flanked on each side by a Doric column.

The treatment of the panels so enclosed is varied to suit the particular need. In the west wall, the lower part of the two center panels is occupied by glass doors leading into the waiting room, while in the two side panels the doors are replaced by plain plate glass windows. On the east side, one panel is occupied by an open doorway into the foyer leading to the barber shop and the men's toilets, another by a plain wall, still another by the train bulletin board and the fourth by the glazed doors to the lunch room.

The south wall, which presents an unbroken face except for one small door, has been set off by four half-columns uniformly spaced across the width of the room. The columns and all wall areas in the concourse to the tops of the columns, 25 ft. above the floor, are of Botticino marble while the decorated entablature and paneled attic, as well as the ceiling, are of plaster. The ceiling, decorated with a small pink



At the Concourse or 72.5-ft. Level

pattern over an old ivory base, presents an unbroken surface except for a skylight, 52½ ft. by 30 ft., surrounded by a paneled border. The stairwells are enclosed in Botticino marble railings with heavy bronze gates, one end of each enclosure supporting a double train indicator in a bronze frame.

In the waiting room, which is 163 ft. by 55 ft. in plan, the floor is Tennessee marble and the wainscot is Botticino marble, which is also extended up and around all openings, while above the wainscot the walls are paneled plaster and the ceiling is ornamental plaster. The room is equipped with benches of Andaman Island Padouk, a vermilion mahogany. A door in the west side of the room leads to rest and toilet rooms for women.

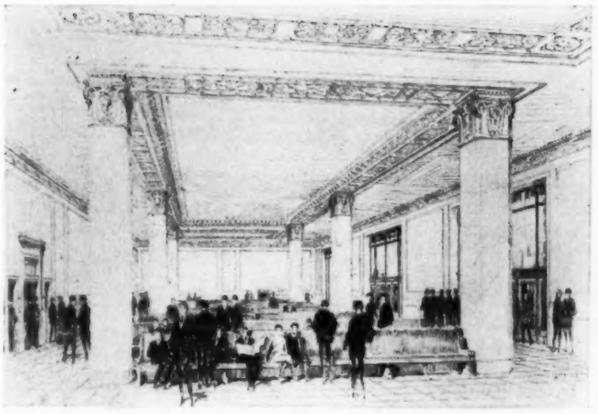
Southwest Corner of the Concourse
The Entrance Portico

One of the Ramps
The Concourse, Looking Toward the Ticket Lobby

Harvey Service

All of the concession space, including not only the restaurant and lunch room but also the various shops and barber shop, has been leased to Harvey, Inc., and the finish, decorative treatment and appointments are all of the highest order. The largest unit of the concession space is the lunch room, its great floor area, 140 ft. by 96 ft., being emphasized by a rather low ceiling height of 10 ft. The floor is Tennessee marble in two shades. The walls are covered with American black walnut, while the ceiling, except for ornamental beams and a cornice of plaster, is covered with a Johns-Manville sound insulation. The center of the room is occupied by three U-shaped counters with space on each side reserved for tables. The counters are of the low, table-height type with the serving floor depressed for the convenience of waitresses. The tops of the counters are Verde antique, the aprons and bases are black and gold, and the dado Loredo Chairro.

The restaurant, provided for more formal service, is an exceptionally handsome room, done in a distinctly modern style. It is 66 ft. by 58 ft. in plan and has an 18-ft. ceiling height. The floor is finished in Belgian black and Tokeen marble laid in a decorative pattern, the walls to the drop ceiling are entirely covered with antique English oak with ebony and holly inlay, while the ceiling is of plaster, set off by an elaborate



A Drawing of the Waiting Room

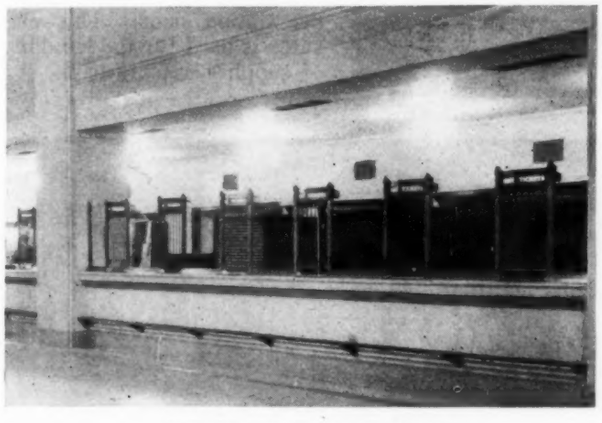
decorative treatment. The entrance to the dining room is through a foyer 44 ft. by 18 ft., to one side of which there have been provided a check room and two small toilet rooms.

Modern Culinary Facilities

Adjacent to the restaurant and lunch room is a most complete and elaborate plant for the storage, preparation and serving of food. In addition to a large manufacturing kitchen and separate service kitchens for the restaurant and lunch room, together with facilities for washing dishes, equipped with a Stanley Olson subveyer, there is a large bake shop equipped with two Peterson gas ovens and two Edison electric ovens. All supplies are received and issued in a commissary storage located on a passage that has direct contact with tailboard space on the east or joint driveway. On this same passageway, but independent of the commissary storage, there is a large general stock room in which are kept the reserve supplies for the various retail shops and other concession spaces. The restaurant auxiliary space also provides complete accommodations for the various classes of Harvey employees, including an employees' cafeteria.

The kitchen and other working spaces are finished with quarry tile floors. The walls have a high wainscot of light gray Faience tile laid with wide joints of a dark gray mortar. The upper portions of the walls and the ceilings are finished in cream-colored Sherwin Williams' Enamelastic. All metal hoods over the ranges are lined with Monel metal.

In addition to the restaurant and lunch room, there

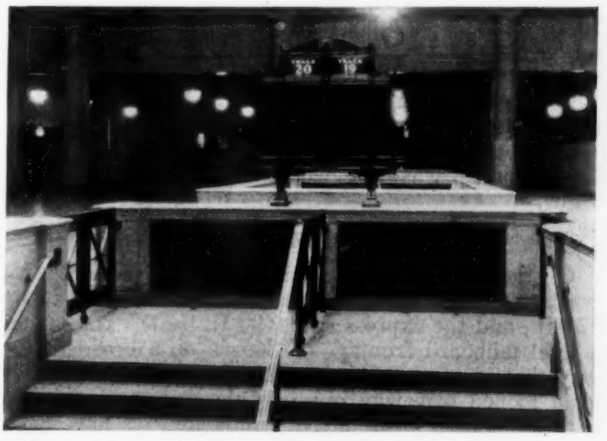


A Panel of the Ticket Counter

are four other food-serving shops in the station, each with its own service kitchen. Probably the most unique of these is the tea room, located on the 85-ft. or street level at the rear of the two elevator lobbies in the Tower building. This room, which has a length of 96 ft. and a maximum width of 21 ft., is finished in a modern French style with English harewood (dyed sycamore) walls, paneled with art mirrors that have been set off effectively by black frames. The floor is made up of alternate squares of Belgian black and Alabama white marble, while the serving counter has a polished Belgian black top and base, and a St. Genevieve marble dado. A distinctive feature of this room is a window occupying a width of 18 ft. in the center of the south wall that affords an excellent view of the entire steam concourse space.

A winding stairway at the west end of the tea room leads to a soda fountain on the floor below and just adjacent to this, on the axis of the station, is a corridor leading to a small dining space directly under the Tower building lobby. Still another place for the serving of food is the sandwich shop located on the west side of the east traction concourse near the north end.

Other concession space is occupied by two book



Gates and Train Indicator at the Head of a Stairway to the Platform

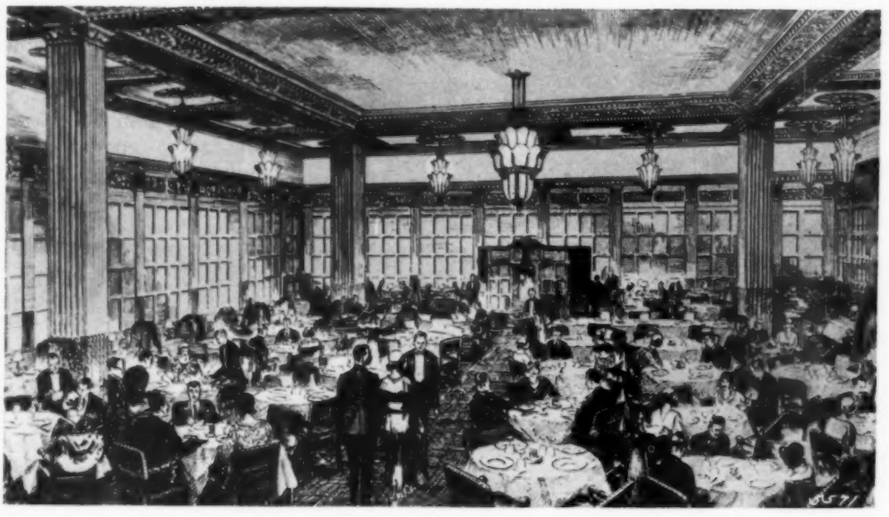
shops, a food shop, a large drug store, apparel shops, a toy store and two candy stores. The barber shop is an especially attractive room, 62 ft. by 30 ft., with a heather-brown Welsh tile floor and Faience tile walls arranged in panels embodying the use of blue, gold and green with ivory borders. Art mirrors with black frames add much to the effectiveness of the treatment. The room is equipped with 22 chairs, each with an individual lavatory.

A corridor leading from the barber shop foyer gives access to the men's free and pay toilets, which are equipped with Standard Sanitary Manufacturing Company's plumbing fixtures. All exposed piping is chromium-plated brass. Equipment of the same character has been installed in the women's toilet and lavatory space, as well as in the many other toilet rooms provided throughout the building for various groups of employees.

A Large Taxicab Stand

At the west end of the south transverse passage is a battery of doors opening out on the taxicab stand, affording 315 lin. ft. of loading space, 190 lin. ft. of

unloading space and parking area for 125 cabs. Just south of the taxicab space is the baggage room, 246 ft. long and from 125 ft. to 218 ft. wide, having 208 ft. of tailboard space along its west side facing a driveway 44 ft. wide. Both this driveway and the taxicab stand are connected with the street level by a ramp ascending westward to a new cross-street between the Prospect avenue and Huron road extensions. This ramp is divided into two lanes, one 27 ft. wide for taxicabs and the other 32 ft. wide for baggage trucks.



Artist's Drawing of the Restaurant

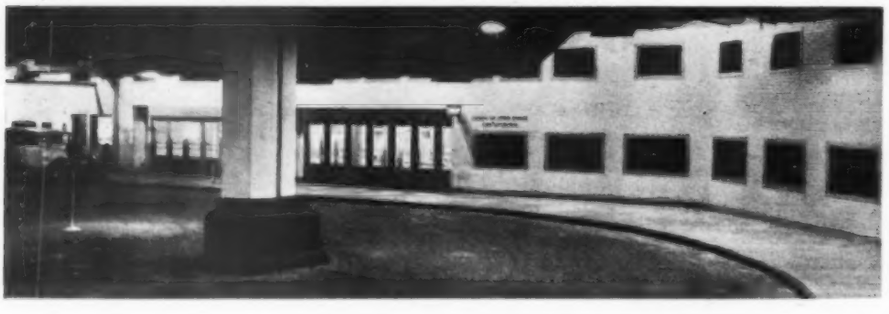
Of the baggage room driveway frontage, which is enclosed with 10 motor-operated Kinnear rolling doors, a length of 126 ft. opens directly into the baggage room, while the remaining frontage serves a baggage transfer room, 42 ft. by 30 ft., and a milk room, 42 ft. by 52 ft. Another doorway with a rolling door opens on the taxicab stand, thus allowing the convenient receipt and delivery of baggage handled in cabs. The baggage room is provided with Fairbanks scales; three automatic dial scales with 4-ft. by 5-ft. platforms and one beam scale with a 9-ft. by 14-ft. platform. Similar equipment was provided in the mail room described below.

Express and Mail Facilities

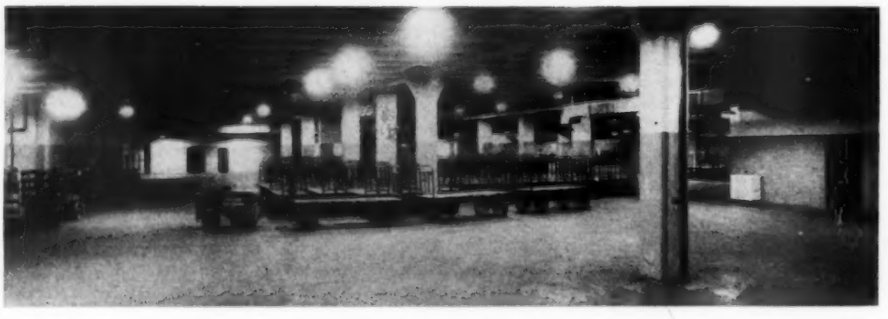
On the east side of the building, in the same relative position as the baggage room, is a mail room, 90 ft. by 121 ft., and the express space, 90 ft. by 184 ft., having a total tailboard frontage of 246 ft. on a broad driveway that is connected with the Huron road extension by a looped driveway ramp. Otis elevators equipped with automatic, push-button, motor controls have been provided to handle baggage, mail and express trucks between the track platforms and the facilities on the floor above. These elevators were arranged in two banks of six elevators each, placed near the ends of the platforms, one bank providing direct access to the baggage room and the other to the mail and express rooms. In order that trucking would introduce a minimum of interference with the use of platforms by passengers, a trucking passage 22 ft. wide has been provided at the station floor level along the south side of the building to connect the baggage room with the easterly elevators.

It will be noted also that the doors of the elevators at the east end of the building open into the mail and express spaces, as well as into the trucking passage. The usefulness of this passage has been greatly increased by the arrangement of the various storerooms and other service facilities in such a way as to afford direct access to the trucking passage. The baggage, mail and express rooms and trucking passage are paved with Kreolite wood blocks and the taxicab stand, baggage driveway and mail and express driveway are paved with brick.

A seventh elevator at the west end of the station connects the track level with the coach yard headquarters which occupy a west wing of the station floor. This elevator is used for the handling of supplies, repairs parts, etc.



A Portion of the Taxicab Stand—Above

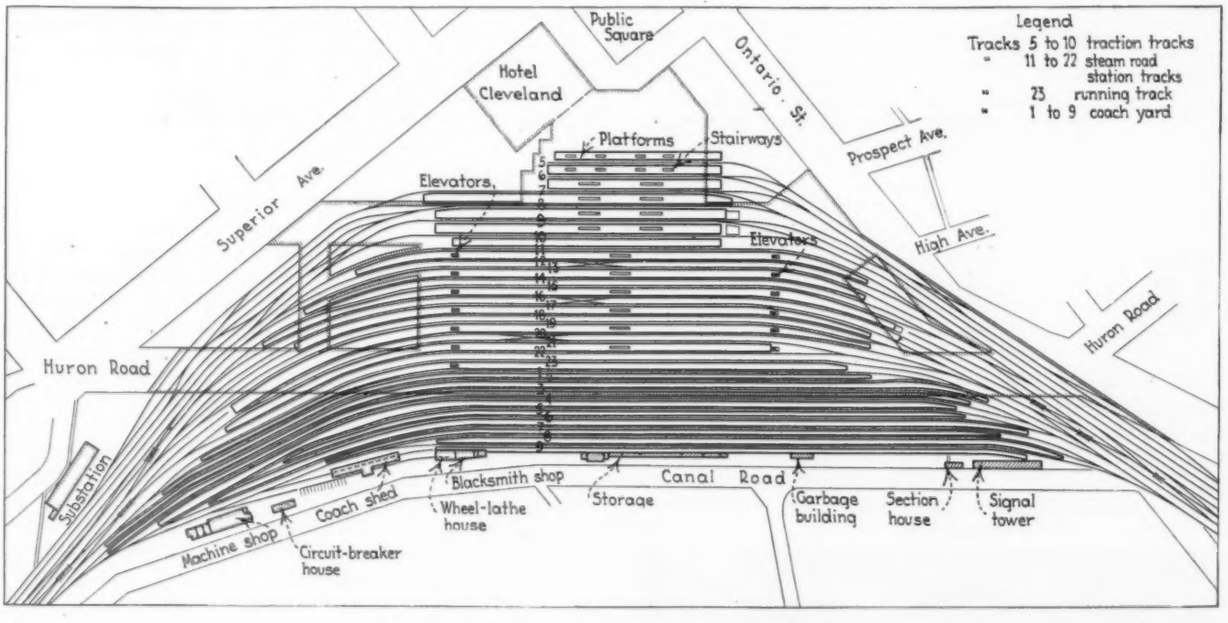


The Baggage Room—At the Right

The Track Level

The track layout at the station calls for an ultimate development of 34 tracks, the first 10 at the north to be used by the rapid-transit trains and the rest by steam railway trains. However, in the initial development, the four most northerly traction tracks have been omitted, while the steam concourse as now constructed, with its south wall temporarily on the north line of Huron road extension, is provided with stairways to six track platforms, namely, those served by tracks No. 11 to No. 22, inclusive. But provision has been made in the plan that will permit of the eventual extension of the concourse to the south so that tracks No. 23 to No, 34, inclusive, may also be used for steam-road service. At present, Track 23 serves as a running track while the space to the south of it has been developed as a nine-track coach yard.

While the steam and traction tracks are at the same level, the two groups of tracks are entirely independent, there being no crossover connections between them. The two sets of tracks differ also in that all of the traction tracks will be spaced from 33 to 34½ ft. apart in order to provide a platform on each side of each track, while the steam railway tracks conform to the common paired arrangement with platforms between pairs of tracks, the track centers across the platforms being 28.79 ft. to 29 ft., except where the curves at each end of the station necessitate a narrower spacing.



Layout of the Station and Coach-Yard Tracks

Unique Arrangement of Stairways

The arrangement of the stairways to the steam road platforms is distinctly out of the ordinary. Instead of conforming to the usual arrangement of a continuous flight parallel with the platforms, the stairways are divided into two flights separated by a landing, the upper flight being at right angles to and the lower flight parallel with the platform. In the case of the stairways to the steam-road platforms, the upper flight and the landing are divided by a railing into two lanes, each 6 ft. wide, there being two lower flights, each 6 ft. wide between handrails, extending to the east and west respectively. The soffits of floor members supporting the station floor are at an elevation providing a clear headroom of 16 ft. 10 in. above top of rail and the transverse flights of the stairways have been placed so as to provide this clearance for a width of five feet over each track and a clear width of 9 ft. 8 in. at an elevation of 15 ft. 3¼ in. above top of rail. The stairwells are enclosed in steel and plaster housings and the treads and risers are of non-slip art marble on the upper runs and steel risers and non-slip cement treads on the lower runs.

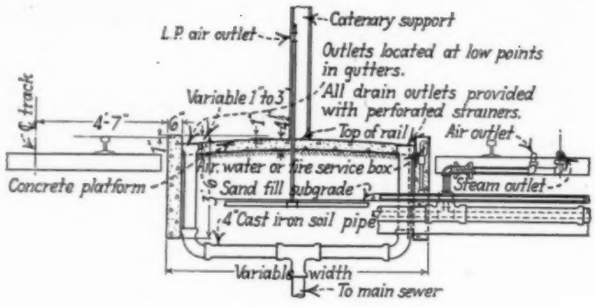
As the station building covers most of the platform area, train sheds have presented only a minor problem, platforms not under the building being covered by a simple design of butterfly shed. No attempt was made at architectural treatment of the surfaces of the concrete fireproofing of the columns and overhead floor framing on the track level, but for the purpose of increasing the light-reflecting value of these surfaces, they have been covered with a cream-colored Medusa cement paint applied with spray guns. This coating was also applied to the interiors of the baggage room, taxicab stand, etc., its selection being determined in part by the fact that it could be applied to damp surfaces, thus making it unnecessary to wait until the concrete had dried out.

All of the tracks connect with each approach except the three most northerly traction tracks which, when laid, will connect only with the east approach. The platforms serving the traction tracks range from 261 to 712 ft. in length, and those serving the steam tracks from 1,193 ft. to 1,511 ft.

All main tracks in the station and the approaches are laid with 127-lb. Dudley section rail and the coach yard with 105-lb. relayer rail. Approach tracks are laid with 7-in. by 9-in. by 8½-ft. ties on 12 in. of rock ballast and 24 in. of sub-ballast, which is granulated slag in the west approach and crushed slag in the east.

Along the platforms, the tracks are supported on a 10-in. reinforced concrete slab, continuous under two tracks, that serves also as the support for the platform curbs. This slab forms the base for the usual center-trough construction in which the rails are supported on 8-in. by 9-in. by 2-ft. 6-in. tie blocks embedded in concrete. The space between tracks is enclosed between curbs to form a pipe or utility trough covered by checkered plates, extending from end to end of the platforms except for gaps of about 210 ft. near the axis of the station, that were introduced to make room for scissor crossovers provided to facilitate setting in or cutting out dining cars, etc. The platforms are slabs of concrete reinforced with welded wire mesh and supported on sand fill. The thickness is six inches except for increased depth around columns and elevator wells.

Turnouts in the station tracks have either No. 8 or No. 10 frogs. The crossovers and slips in the throats of the station yard are No. 10 and No. 12, while a number of No. 16 crossovers and slips have been installed in the west approach. Railbound manganese frogs have been used for high-speed turnouts and self-guarded frogs for all others. The tracks are anchored with Fair anti-creepers. The frog and switch work was



Typical Section of Coach-Yard Platforms

supplied by the Cleveland Frog & Crossing Company and the track laying was done by the Hecker-Moon Company.

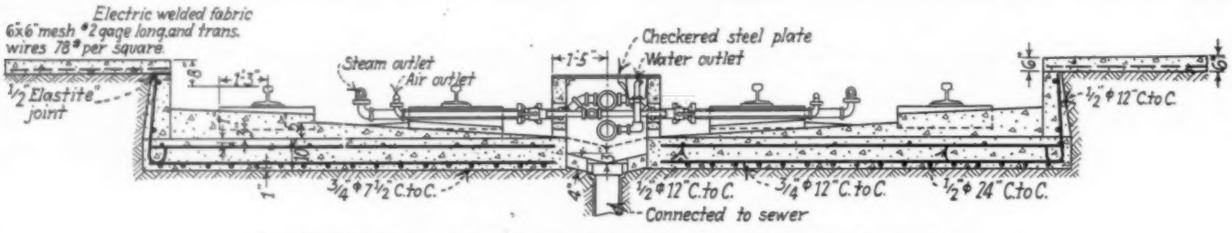
The Coach Yard

The coach cleaning and repair facilities embrace nine long coach tracks and two service tracks in the arch south of the station tracks, and a group of small buildings ranged along the south side of the south or outer track. In addition, offices, employees' locker rooms, storerooms and certain repair facilities are housed in the

One of the Platforms

west end of the station building. The yard tracks are spaced from 19½ to 22 ft. center to center across platforms and vary from 1,446 ft. to 2,120 ft. in length. They are connected to the throats of the station yard at each end.

The yard is noteworthy for the completeness of the facilities provided for its operation, the construction of the platforms being of particular interest by reason of the provision made for drainage. As the primary



Typical Section of Track and Platform Construction at the Station

need for drainage is to dispose of the water used in washing the sides of the coaches, it was deemed best to dispose of this water on the platforms rather than to allow it to drain into the track space. To obtain this result, the platforms were constructed, as shown in the section, with the precast concrete curbing units set higher than the edges of the platform paving, which slopes from the center line to the edges and longitudinally to four-inch cast-iron soil-pipe drains installed at intervals along the platform varying from 100 to 200 ft.

Water service is provided at intervals of 75 to 110 ft. in each platform from Murdock service boxes installed in the curbs. Low-pressure air is supplied at the same intervals from either a curb box or a column outlet. High-pressure air for charging brake pipes, and steam for car heating is provided at outlets between the rails of each track, near its ends and at one intermediate point, these outlets being equipped with Barco flexible connections. Air and steam service of the same character is also provided for the station tracks, and water service boxes for replenishing water storage in coaches have been installed in the service troughs between the station tracks at intervals of 100 ft. Both the coach yard and station platforms are equipped with fire hydrants and hose reels at intervals of about 200 ft.

Service Buildings

In the narrow strip of ground between coach-yard track No. 9 and the north side of Canal road is a group of buildings of various sizes, some of them of steel-frame and brick-wall construction while others are portable steel structures. These house the various classes of service facilities required for the operation of the

coach yard and the terminal in general. One structure houses a machine shop, a crew room, a section tool house, a signal maintainer's tool house and a transformer room, and an installation of three air compressors, together with two motor-generator sets for signal power supply in the basement. Another is a coach shed, equipped with two Whiting wheel drop pits from which a wheel track leads to a wheel-storage rack and wheel-lathe house. Other buildings provide for a blacksmith shop, car-battery charging, transformers for electric snow-melting current, carpet cleaning, storage for stocks of various kinds, and a garbage disposal elevator for the delivery of dining car garbage from the track level to trucks in Canal road. Two Elwell-Parker electric six-ton lift trucks have been provided for the handling of heavy parts incident to coach repair work and two Yale & Towne trucks for use in handling ice.

Heating, Lighting and Ventilating

As a plant of the Cleveland Electric Illuminating Company is located only about a quarter of a mile from the station, it was found possible to obtain steam for all heating purposes as well as electrical power from this public service company. Accordingly, a steam main was laid from the power plant in Canal road to the center of the station, whence it was carried under the station structure in a reinforced concrete service tunnel, 22 ft. by 11 ft., extending to the Public Square. Because of this arrangement, no powerhouse was required, the necessary space being provided at the station level under the various air-right structures for house pumps, hot-water heaters and other mechanical facilities incident to the operation of the various buildings. Owing to the low elevation of the station facilities, the water pressure on the city mains is sufficient for all water service within the station without the introduction of booster pumps.

The air-right buildings are heated by direct steam radiation, but the use of steam heat in the station facilities introduced complications because of the difficulty of providing adequate protection against freezing of the gravity condensate return in the exposed track space. For this reason, the station facilities and certain low-level portions of the overhead buildings are heated by forced circulation hot water. All water for heating and for sanitary use is heated by steam in Sims hot-water heaters.

The Ventilation System

One of the outstanding characteristics of the station building is the almost complete absence of outside exposure. In all of the facilities devoted to station use, there are only 54 windows. Consequently, artificial illumination and ventilation were among the most exacting of requiremeints, the demands of ventilation being fulfilled by an installation of 56 fans with a total capacity of 1,557,628 cu. ft. of air per minute, the largest individual fan having a capacity of 60,000 cu. ft. The system was designed to provide 10 complete changes of air per hour throughout the entire station plant.

Ventilation in the public space, concessions and working rooms embraces both the delivery and exhaust of air, 24 fans with a total capacity of 505,476 cu. ft. of air per minute being provided for the delivery of air to station space. But in the taxicab stand, baggage, mail and express spaces, where the problem is primarily that of the removal of the exhaust from motor-vehicle engines, ventilation is confined to exhausting air, some of the fresh air being taken from the track level space through grilles.

All fresh air delivered by fans is filtered through Reed self-cleaning air filters and is tempered by passing it through American Radiator Vento heaters, with thermostatic control of both the steam supply and the by-pass dampers. The fans were furnished by the American Blower Company and are driven by General Electric motors. They are installed in groups in various parts of the building, with inlets or outlets in the roofs of the station or the air-right buildings. The largest duct is 17 ft. wide by 5 ft. deep. The duct work was exceedingly complicated because of the limited space available for it in certain portions of the building. With the exception of eight tons of Everdure metal used in the duct that carries acid fumes from the battery-charging rooms, the ducts were made of galvanized iron.

While the tempering of air was an important feature of the ventilation, provision was also made for cooling air in hot weather in the restaurant and lunch room facilities by the installation of an extra refrigerating unit in the plant provided for cooling brine for the many refrigerator boxes in the Harvey concession space. One 75-ton Carbondale machine was installed for air cooling and two 50-ton units of the same make for general refrigeration. The 75-ton machine supplies brine at a temperature of 20 to 25 deg. F. to coils in the air washers for conditioning air as to both temperature and humidity. The two 50-ton machines are equipped to deliver brine of two temperatures, namely at 15 deg. F. for general refrigeration and at 0 deg. F. for freezing and hardening ice cream. Machines of the absorption type were selected because of the necessity of reducing vibration to a minimum. The heating, ventilating, plumbing and refrigerating were installed by the A. R. Brueggeman Company of Cleveland.

Electric Appurtenances

Electric power is supplied to the building as 230/115-volt direct current, the distribution being arranged as a three-wire system to permit the use of both 230-volt motors and 115-volt lamps. The power is delivered to two main switchboards, located on the mezzanine floor in the east and west sides of the building, through 11 lead-covered feeder cables of 2,000,000 circular mils each. Owing to the large number of motors that are in operation without attendance in various parts of the building, a Sharp magnetic motor supervisor has been installed with a 110-station listening board, which enables the attendant to plug in a head set on any motor and by listening to determine whether it is in operation.

In keeping with the use of heavy cast bronze for door frames, show windows, ventilator grilles, etc., throughout all of the public spaces in the station, cast bronze has also been employed extensively in the lighting fixtures in the lobbies, concourse, waiting room, etc.

In the portico, these fixtures are in the form of cylindrical lanterns suspended from the ceiling by chains. Each of these contains twelve 100-watt and eight 200-watt Mazda lamps. Four lanterns, each enclosing twelve 100-watt lamps, are installed in the adjoining building entrance lobby. In the various lobbies on the station

floor the lighting units consist of frosted glass bowls ribbed and edged with bronze and suspended by a chain from the center of each panel of the groined ceiling. The lighting of the steam concourse embraces 10 chandeliers consisting of an assembly of three bronze rings equipped with sockets for a total of 121 40-watt frosted Mazda lamps. The track level, baggage room, taxicab stand and other industrial spaces are illuminated by 150-watt and 200-watt lamps placed in Abolite reflectors.

Floodlighting the Tower

Particular attention was given to exterior illumination. The front entrance is lighted by street lamps on ornamental standards placed 30 ft. apart at the curb line, each post supporting two glass globes containing two 25,000-lumen lamps. However, the most impressive feature is the floodlighting of the tower, to the end that it is visible at as great distances by night as by day. This effect has been obtained by the use of 648 100-watt lamps in box reflectors and 228 General Electric floodlights equipped with lamps in sizes ranging from 200 to 1,000 watts. In addition, there are six Sperry gyroscope beacons and six 1,500-watt lamps at the forty-ninth floor, making a total floodlighting load of 194.6 kw.

The electrical facilities include provision for charging the batteries of power trucks. For the handling of baggage and mail in the station, 5 tractors and 4 low-platform, load-carrying trucks and 150 trailers are used. The trucks and tractors were supplied by the Baker Raulang Company and the trailers by the Mercury Manufacturing Company. All of the electrical wiring for power and lighting in the terminal area was installed by the Hatfield Electric Company, Cleveland.

One of the unique features of the station facilities is the provision made for the dumping and cleaning of the soil cans placed under the hoppers of parked sleeping cars. The essential element of these facilities is a machine designed by a Terminals Company engineer which does away entirely with the manual handling of these cans. It consists of a large metal drum mounted over a sewer connection, containing a frame in which three cans may be mounted simultaneously. After the cans have been inserted in this frame in an upright position and the hatch on the drum has been closed, the frame is rotated so as to place the cans in a dumping position, while hot water is sprayed into them.

Electrification — An Important Feature

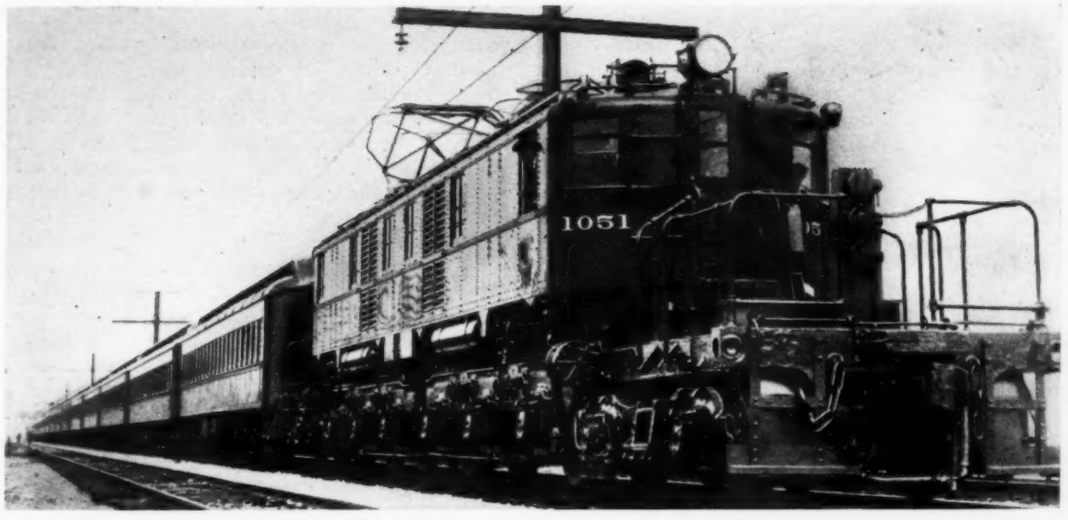
The Cleveland Union Terminal electrification is the first project of its kind in the United States where tunnel operation is not involved, that provides for the hauling of main line passenger trains through a large city with a transfer to steam power at each end of the electrified section. The electrified territory extends over 17 miles of route between terminals established at Collinwood on the New York Central, 10.75 miles east of the station, and Linndale, 6.35 miles west of the station on the Big Four. It embraces about 60 miles of tracks and requires the service of twenty-two 204-ton electric locomotives, receiving 3,000-volt direct current energy from an overhead contact system. These locomotives haul New York Central passenger trains between Collinwood and Linndale, and Big Four trains between the terminal station and Linndale. In-so-far as the Nickel Plate is concerned, their use is confined to about five miles of line betwen East Fortieth street and West Thirty-Eighth street. Steam locomotives of incoming Nickel Plate passenger trains, after being released, for example, at West Thirty-Eighth street, proceed over the Nickel Plate main line across the Cuyahoga valley to pick up their trains again at East Fortieth street.

As has already been pointed out, provision has also been made in the plans of the terminal area for the development of a complete east and west rapid-transit system, using a portion of the railroad facilities as a central terminal. This system will use 3,000-volt direct current, with multiple-unit motor cars, supplied from independent substations. The substation equipment for this service is expected to exceed somewhat in capacity the present substations of the Cleveland Union Terminals Company and provision may be made for ready interconnection between the two systems, thus supplying an adequate reserve for either in case of an interruption to the service of the other.

Power is distributed from two automatic substations; one located 3½ miles west of the Union station, with an installed capacity of 9,000 kw., and the other 7¼ miles east of the station, having an installed capacity of 6,000 kw. Power is received at these substations by underground cables from the Cleveland Electric Illuminating Company at 11,000 volts, 3-phase, 60 cycles, and converted in the substations by motor-generator sets to 3,000 volts direct current.

The motor-generator sets are of the five-unit type, consisting of one 11,000-volt synchronous motor direct-connected to two 1,500-volt d.c. generators and two exciters. The two 1,500-volt generators are connected permanently in service. Each set has a full-load capacity of 3,000 kw. and, following full-load temperatures, is designed to carry either 150-per cent load for two hours or 300-per cent load for five minutes. The exciter supplying excitation to the synchronous motor is compounded with the load current and so adjusted that approximately unity power factor is maintained throughout the complete range of loads. The automatic control maintains a constant direct-current bus voltage up to the ratings of the sets and beyond this point a constant current output. This control also provides for a proper division of load between the sets. Each motor-generator set has an individual forced-ventilation system, including air filters of the continuous type and motor driven fans. Cool air is taken in from the outside, cleaned and forced through the machines from below. The heated air is discharged into the motor-generator room and removed from it by roof ventilators. All machine and d.c. feeder breakers are of the high-speed type of 2,000-ampere capacity.

Each substation is remotely controlled from a power supervisor's office in the Union station. The supervisory control system is of the synchronous selector type. The starting and stopping of each motor-generator set, as well as the control and indication of the alternating current supply lines, the d.c. feeders, and other functions in both substations and six circuit-breaker houses, is centered in the power supervisor's office. The power supervisor is thus informed at all times as to the operating conditions of the equipment. Electrical apparatus in the substations and circuit-breaker houses was supplied by the General Electric Company. Exide storage batteries insure power



An Electric Locomotive and Train

supply for the control equipment. The air filters were supplied by the American Air Filter Company. Power and control wiring was done by the firms of Dingle & Clark and the Hatfield Electric Company.

Sectionalizing

A scheme of sectionalizing is used which makes it impossible for a passing pantograph to make a dead section alive. Six circuit-breaker houses are provided, as shown on the map. The breakers in these houses are of the high-speed type and are controlled from the supervisory board.

The method of sectionalizing used is shown in the diagram. The line marked "Bus" at the top and the switches are in the circuit-breaker house. The line *BAC* represents the contact wire over the tracks, the point *A* attached to a cross bridge being raised. A second contact wire *DE* is carried alongside the contact wire *BAC* and the points *D* and *E*, attached to the bridges on either side of the circuit-breaker house, are also raised.

As a pantograph proceeds from left to right, it contacts first only with the wire *BA* at *B*. As it proceeds toward *A*, it comes in contact with the contact wire *DE* and for a short space contacts with both wires. As it proceeds farther it touches only the wire *DE*. Still farther, it comes in contact with *AC* and later loses its contact with *DE*.

The auxiliary wire *DE* is level with *BAC* at two points, but these points are so far apart that they cannot be spanned by the pantographs on two locomotives.

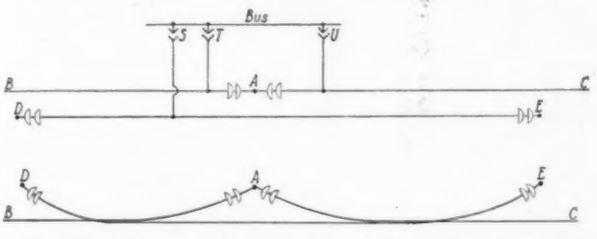
Catenary

All of the catenary supports are set in concrete foundations. Center-pole construction, consisting of a Carnegie H-section pole with brackets made of channel sections, is used where there is sufficient clearance between tracks. Bridges consisting of latticed columns and trusses are used where track centers do not permit center poles. At the top of each center pole and on one of the bridge columns, a six-pin cross-arm is now used to carry the high-tension signal cable and, in the future, may carry other signal wires and feeders. Two 10-in. suspension type insulators are used to support the main messenger, which consists of a 350,000-circular-mil composite main messenger cable, composed of 19 wires of Calsun bronze surrounded by 16 wires of hard-drawn copper. The breaking strength of the cable is 39,300 lb.

Supported from the main messenger by hangers spaced 20 ft. apart, is a 4/0 auxiliary messenger cable consisting of 19 wires of hard-drawn copper and having a breaking strength of 9,600 lb.

Two 4/0 grooved Hitenso C contact wires, each having a breaking strength of 12,150 lb., are supported at alternate points by clips from the auxiliary messenger. These clips are spaced 10 ft. apart on the auxiliary messenger and 20 ft. apart on each contact wire. Yard construction consists of a ⅝-in. 19-strand bronze messenger and the two contact wires, one of which becomes the auxiliary messenger. No paralleling feeders are used and power is supplied directly from the substation to the contact system and tapped directly into the circuit-breaker houses.

The steady braces used on tangent line consist of a



Diagrammatic Plan and Elevation of Sectionalizing System

Isolated section breaker S is interlocked with adjacent mail-line breaker T and U so that it must be open if either of the others is open.

10-in. pedestal insulator in series with a wood stick insulator, the latter being attached by a solid bronze rod and clip to the auxiliary messenger.

The pull-offs used on curved track are attached separately to the auxiliary messenger and each of the contact wires. The attachments to these wires are carried through an equalizer, which holds the wires in their proper position, to two 8½-in. suspension-type insulators. These insulators are supported by a chain, a slot being provided in the supporting bracket on the bridge into which the chain is hooked. This arrangement allows for adjustment of the pull-offs. The track bonding consists of two 4/0 pin-type expansion bonds per joint, concealed under the rail-joint bars. The tracks are cross bonded at intervals with Parkway cable, and impedance bonds are used at signal locations. Main and auxiliary messengers and the contact wires were supplied by the Anaconda

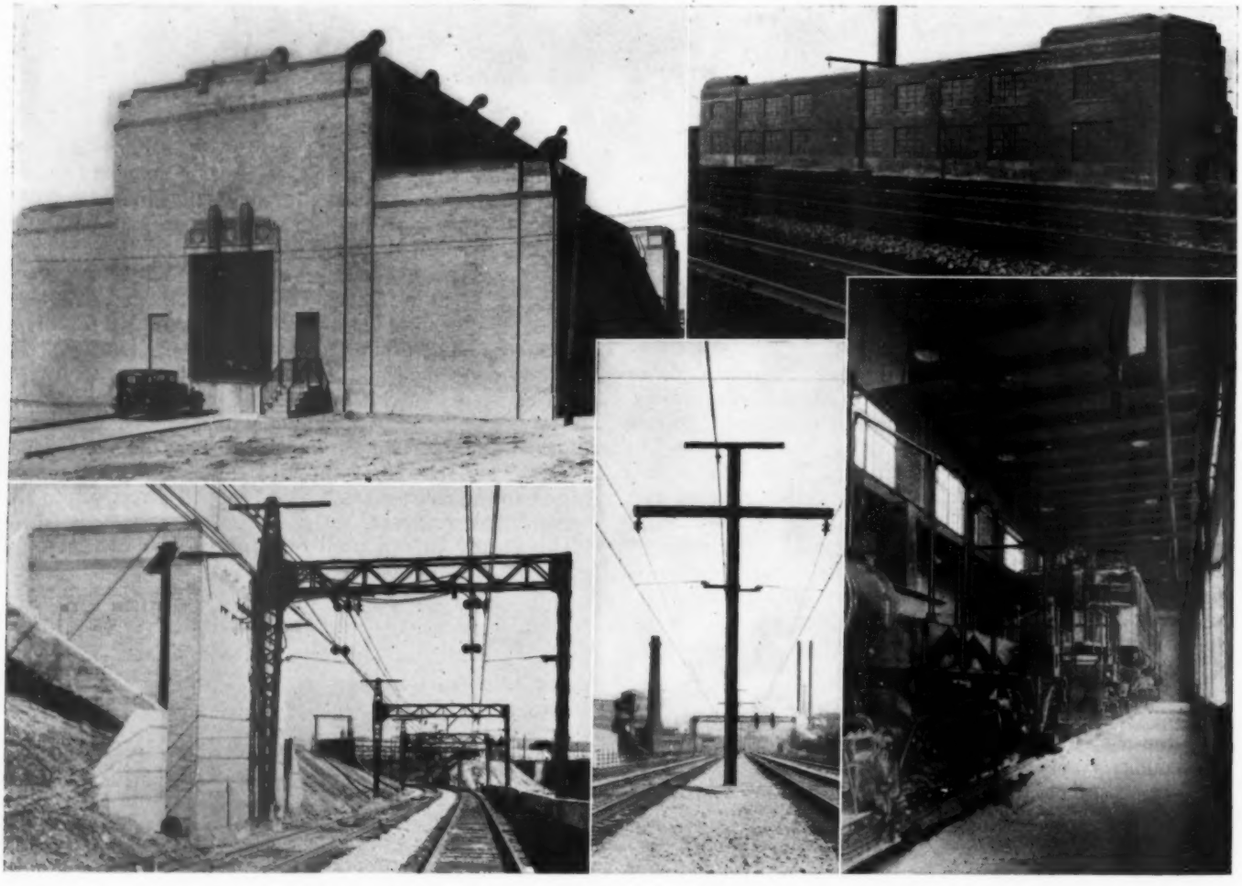
Wire & Cable Company, clips and hangers by the Ohio Brass Company, bonds by the American Steel & Wire Company, and insulators jointly by the Locke Insulator Company and the Ohio Brass Company. The steel supporting structures, which involved a great variety of units of differing dimensions and designs, were fabricated under a contract awarded to the Fort Pitt Bridge Works, and were erected by the Bass Construction Company on foundations built by the H. E. Culbertson Company. The catenary and allied work was done by the Pierce Electric Company.

Locomotives

A total of 22 locomotives are being used, each capable of starting a train of fifteen 85-ton cars on a 1.56-per cent grade uncompensated for a 5-deg. curve, and able to maintain a speed of 53 miles per hour with this train on level, tangent track. Each locomotive consists of a box-type cab with an operating compartment at each end. This cab is mounted on two six-wheel motor trucks, connected by an articulation consisting of a large vertical pin working in a ball and socket joint, thus providing maximum flexibility with minimum lost motion. The frames of these motor trucks are of cast steel with the outer ends extended to take the leading truck center plate, provide pockets for the friction draft gear, and at the same time form a platform on each end of the locomotive. The spring rigging consists of a combination of semi-elliptic and helical springs, so equalized as to provide, with the leading trucks, a three-point support at each end of the locomotive. The driving wheels are solid rolled steel, 48 in. in diameter and are driven by six motors through twin cushion gears.

The guiding trucks also have cast-steel frames, with 36-in. wheels on 8-ft. wheelbases. A rocker centering device is provided on each leading truck. Switchmen steps, in place of pilots, have been furnished on these locomotives since they will be operated in switching service part of the time.

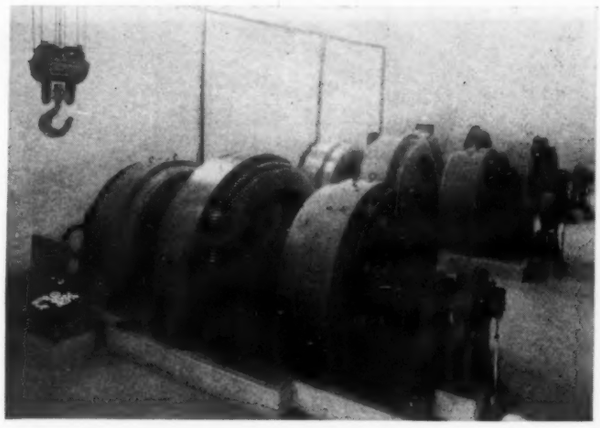
The motors are 1,500-volt, direct current, insulated for 3,000 volts. Two motors are connected permanently in series, and are arranged for the following combinations: Six in series; three in series, two in parallel; two in series, three in parallel; in addition two steps of field control are provided for each of the above positions. The motors are cooled by forced ventilation furnished from two blowers connected in series across the 3,000-volt circuit. The total capacity of the two blowers is 16,000 cu. ft. per minute.



Upper Left—Substation No. 1, Upper Right—One of the Locomotive Inspection Sheds, Lower Left—Circuit Breaker House and Sectionalizing Point in Overhead Wires, Center—Center-Pole Type of Conductor Support, Lower Right—Interior of Inspection Shed

The high tension contactor and switch compartment is located in the center of the locomotive, with passageways on each side. This compartment was built separately and was wired completely on the floor of the shop before being installed in the locomotive. This permitted considerable saving in time, and also resulted in better workmanship. The main contactors, series-parallel switches, reversers, pantographs, etc., are operated by air, controlled by electro-magnets.

There are two 150-cu. ft. air compressors with driving motors connected in series across the 3,000-volt circuit.



Interior of Substation No. 1

One compressor is located in each end of the apparatus cab.

A dynamotor with two armature windings connected in series across the 3,000-volt circuit acts as a balancer for the two compressor motors. The dynamotor also furnishes power for the low-speed connection of the blowers or for operation of a lone compressor. On the end of the dynamotor is mounted a 3-kw. 40-volt generator for charging the lighting and control battery.

Multiple-unit control with necessary coupler connections, etc., is furnished which will allow multiple operation of two locomotives in case it is necessary to handle extra-heavy passenger trains.

There are two pantographs on each locomotive, with an operating range from 15 ft. 3 in. to 21 ft. 7½ in. above the top of the rails, either pantograph being of sufficient capacity to handle the current required by one locomotive. Each pantograph is of the double-shoe type, air raised and gravity lowered. There is a grounding and disconnecting switch at each pantograph, operated by a handle located at the top of the ladder leading to the roof of the cab.

In front of the engineman's position is a push-button switch box from which all auxiliary apparatus can be operated. The operating cabs are heated by 3,000-volt heaters enclosed in cabinets through which air is blown by small motors, forcing heated air into the cab near the floor line. The front windows of the operating compartments are equipped with non-shatterable glass and clear-vision windows.

To furnish steam heat for the passenger train, each locomotive is equipped with a vertical, fire-tube, fuel-oil boiler. The oil is atomized normally by steam from the boiler, but air from the main reservoir is used for starting. These boilers normally evaporate 4,000 lb. of water per hour. A combination fuel-oil and feedwater tank is provided in which the fuel oil is fed to the burner by gravity and the water is forced into the boiler by the main reservoir air pressure. The feedwater is preheated in a series of copper coils located in the bonnet just under the top tube flue sheet. A deflector is installed in the stack to deflect the heated gases from the catenary construction.

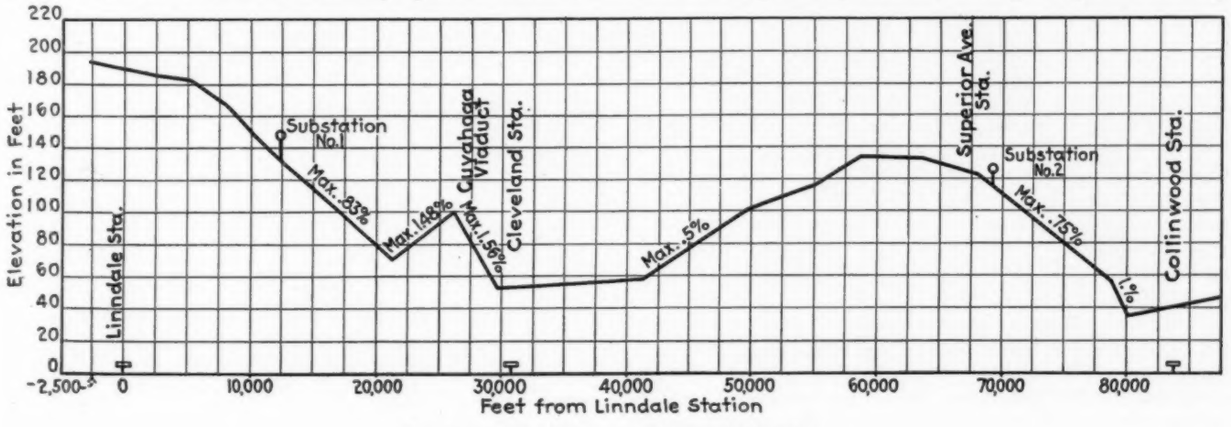
General Data

Axle arrangement	2-C-C-2
Total weight	408,000 lb.
Weight on drivers	300,000 lb.
Weight on trucks	108,000 lb.
Length between coupler faces	80 ft.
Total wheelbase	69 ft.
Driving wheelbase	39 ft.
Rigid wheelbase	15 ft.
Diameter of driving wheels	48 in.
Diameter of truck wheels	36 in.
Gearing, pinion	27
Axle	74
Total one-hour rating, locomotive	3,030 hp.
Continuous rating, whole locomotive	2,635 hp.
Tractive force at 25 per cent adhesion	75,000 lb.
Tractive force at 35 m.p.h. (2,700-volt line)	50,500 lb.
Tractive force at 50 m.p.h. (2,700-volt line)	14,500 lb.

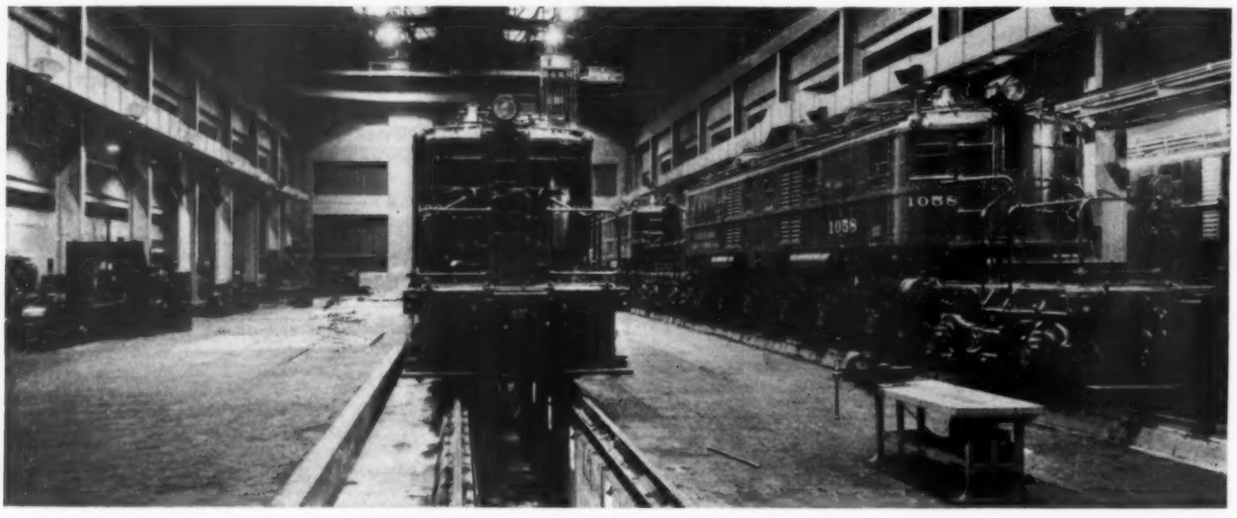
The locomotives were built by the General Electric Company and the American Locomotive Works. The locomotive bed castings, cab underframes and truck frames were supplied by the Commonwealth division of the General Steel Castings Company.

The Supervisory Control Board Located in the Terminal

A repair shop for the maintenance of the electric locomotives was built at Collinwood. It is a brick and steel building 220 by 168 ft., having a high central bay



Condensed Profile of the Electrified Line



Electric Locomotives in the Shop at Collinwood

with a flanking bay on each side extending the full length of the building. In the central bay are two through tracks and one shorter truck-and-wheel track. Drop pits with Whiting hoists for wheels and trucks connect these tracks and a 50-ton traveling crane serves the entire area. One bay houses the machine shop and various facility rooms, while the other bay, which is occupied by rooms for the storage of supplies, is provided with a track running the entire length of the building and a short track used for washing locomotives.

An extension to the main shop contains heating equipment and a blacksmith shop. The shop is heated by hot air delivered through ducts from two fan and steam heater installations, while the small rooms are heated by direct radiation.

Two buildings have been provided for daily inspection of locomotives, one at Collinwood and the other at Linndale. Each will house two locomotives and is equipped with a few machine tools, a heating system and Worthington air compressors.

The 3,000-volt power is dead-ended outside the shop and inspection sheds, the locomotives being moved inside the building by 250-volt power supplied by motor-generator sets. The sets in the inspection sheds are rated at 50 kw. each and the two in the shop at 300 kw. each. The latter also provide power for the operation of machine tools and cranes.

All enginemen assigned to the operation of electric locomotives were provided with an engineman's instruction book, prepared especially for the type of locomotives purchased. The book describes and pictures parts of the locomotives, provides safety instructions, describes tests and operation and suggests remedies for simple failures. All enginemen were given 10 days training for which they were paid.

The first four days were devoted to lectures and instructions on the locomotives and the remaining six days to training in actual operation, first with the locomotives light and during the final four days with regular train load.

Simplified Interlocking Employed

The outstanding feature of the interlocking facilities at the Cleveland Union Terminal is that all of the switches and signals on tracks used by the steam roads, throughout the four miles of terminal property are controlled from one interlocking machine, having 576 levers. Not only is this the largest single interlocking ever installed, but it also embodies a number of features and refinements in design which mark a forward step in the evolution of power interlocking. The signal station, a fireproof brick and concrete structure 144 ft. long and 17 ft. wide, is located just north of Canal road near the east throat of the station track layout. The interlocking equipment, including the power switch machines, signals, and control facilities, was furnished by the General Railway Signal Company, and was installed by Cleveland Union Terminals Company's forces.

The use of one interlocking was made possible primarily by installing, over the interlocking machine, three large illuminated track diagrams that provide such accurate information as to the position of trains within the terminal limits that no advantage would have been gained by locating separate towers at points where the levermen could see the tracks. In fact, such a plan was impracticable in this case. On the other hand, with the one interlocking, the control insures a thorough co-ordination of all train movements and is effected with a minimum of communication between the men in charge. The train directors' desks are located in the bay window space at the front of the operating room, where telephone and teletype apparatus have been installed for the transmitting or receiving of necessary information concerning the arrival or departure of trains, as well as switching movements in the terminal. These directors inform the levermen of the train movements to be made and each of the four levermen handles a certain section of the machine to operate the switches and signals for the desired routes.

Important Interlocking Developments

In order to speed up operation, simplify the apparatus and reduce the maintenance and repair costs, several new ideas which embody decided departures from past interlocking practice, were developed and applied for the first time at the new Cleveland station.

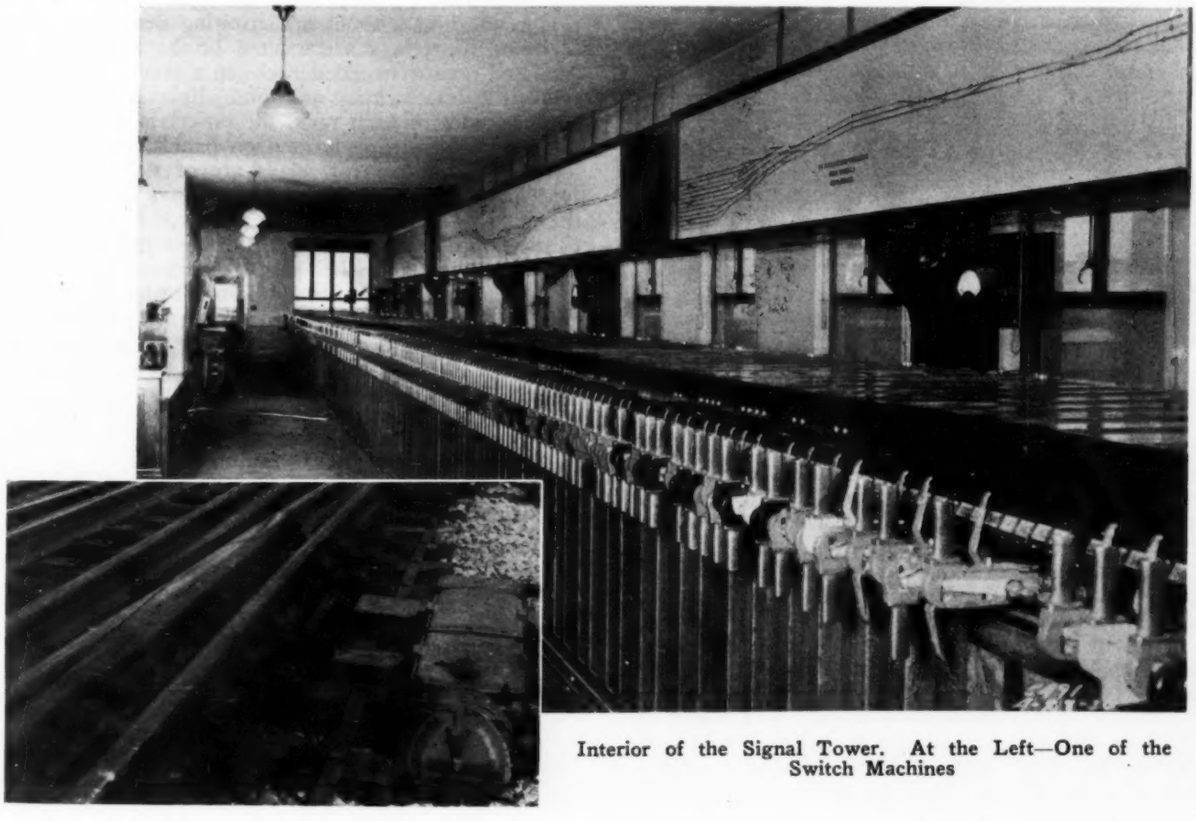
An outstanding feature is the elimination of lock rods for the interlocked switches. As the track is constructed with 127-lb. rail, using heavy switch rods and adequate braces and plates, it is practically impossible for a switch point to roll. Further, the Model-5A switch machine, as used on this plant, includes a dog in the slide-bar mechanism which locks the cam that operates the throw bar of the switch, thus providing a reliable means of holding the switch in position, a function for which lock rods have been required previously. In addition, the Type-SS control system for the interlocked signals includes circuits through independent point detectors, thus insuring that the signals will not be cleared unless the switches are in the proper position. Therefore, in view of the fact that the throw rod can be effectively locked in the switch machine and the exact position of the switch can be checked by the signal control circuits, it was decided that the lock rods were unnecessary.

In order to speed up the operation of the levers of the interlocking machine, the indication locking was eliminated, with the result that the levers for the switches and signals for a route can be pulled to complete stroke as fast as the leverman can handle them, without waiting at each lever for the switch to complete its movement and give the indication. As a consequence, the operation of the several switches is practically simultaneous, and as soon as the last one is over and locked, the signal clears. An entire line-up, involving the throwing of three switches, can be completed in 4 or 5 seconds, as compared with 15 or 20 seconds with equipment of the earlier type.

The switch-indicating circuit utilizes what is termed a "WP" relay which is controlled in such manner as to guarantee that the position of the switch point corresponds with that of the controlling lever. In the control of the "WP" relay, two sets of contacts in the switch machine are employed, one set being actuated by the pole-changer and the other set by the point detector. This "WP" relay circuit is also carried through contacts on the lever circuit controller and on the indication selector, and is operated by alternating current. A common wire serves for both the d.c. operating circuits and the a.c. indicating and locking circuits for each individual operated unit.

Why Indication Locking Was Omitted

The principle on which the elimination of the indication locking was based is that with the advent of electric route and detector locking, the additional indication lock on the signal-control lever performs no function except to delay the release of the mechanical locking until the signal controlled by that lever has displayed its most restrictive indication. It was decided that with the proper design of signal-control circuit, it was unnecessary to maintain a switch-control lever in the indicating position until the dynamic indication is received, because the only function of the indication magnet is to disarrange the mechanical locking between levers to such an extent as to make it impossible to reverse a signal lever governing a route until the indication has been received. Therefore, it was believed that indication magnets were unnecessary inso-far as the performance of the plant was concerned, because all of the other electrical features have been retained. When the switch machine completes its throw, the dynamic indicating current operates an indication selector and the signal controls are so arranged that a signal will not clear unless all of the switches have returned a dynamic indication and have operated their respective indication selectors accordingly. All of this is accomplished, however, without any delay in releasing the mechanical locking between levers, which is used in order to enforce a predetermined sequence.



Interior of the Signal Tower. At the Left—One of the Switch Machines

In addition to the other features, a new type of color-light dwarf signal was developed especially for the Cleveland Terminal, the special requirement being to provide a fourth indication to be used when desiring to close up two trains on one track, the special aspect being red over yellow, which indicates to the engineman "proceed at slow speed prepared to stop short of another train which is occupying this track." This fourth indication is of particular assistance when making switching movements. The other three indications are: Yellow—"proceed at slow speed prepared to stop, track unoccupied"; green—"proceed, track unoccupied, next signal clear"; and red—"stop."

The signals are the Type-SA, single-lens unit operating to three positions, the special design signal case being so constructed that the center of the signal lens is 10¼ in. above the level of the top of the rail. The additional light unit, to give the special red-over-yellow indication, is located in a separate compartment at the top of the case, the center of the lens being 16 in.

A Typical Installation of Signals on a Catenary Bridge. In the Insert—A Dwarf Signal

above the center of the main signal lens. The signal case was designed as a unit to house the signal units mentioned, as well as the terminals for wires. As a special feature to reduce the effects of vibration on the mechanisms, a coil spring was placed over each of the four anchor bolts protruding from the concrete foundation, the signal case being set on these springs and held down by special nuts made of lead. These will strip off and permit the signal to be forced out of position in case it is struck by objects or materials falling from trains. In one instance already, this feature prevented serious damage to a signal.

All of the signals within the station layout are of this special dwarf type, mounted on the ground, except in a few places where the proper clearance could not be secured, in which cases the signals are mounted on overhead structures. Outside the station area the signals are the regular color-light type mounted on the catenary bridges.

Interlocking Tower

The 576-lever control machine, which is about 95 ft. long, is arranged in six sections to increase the flexibility of operation. Six ammeters are provided, one for each section. There are three track diagrams, one at the center embracing the entire layout and one at each end, covering the east and west approaches respectively, including the corresponding half of the station layout. The levers are of the latest type with the preliminary latch-locking feature which eliminates any strain on the mechanical locking structure when operating the lever.

Three sets of lever lights are provided on each switch-operating lever. The top light is a small white bull's-eye which is lighted during the operation of the switch and is controlled through a local circuit carried through the corresponding "WP" relay. The next light is a red unit, larger than the white light above it, and is illuminated only when the cross-protection relay has opened. The third light is the white number light with numerals etched in blue, this light being illuminated whenever the electric lock is de-energized. The signal levers have only one light, namely, the white light with numerals etched in blue, which is lighted when the signal has cleared.

A distinctive feature of the operating room is the ½-in. cork flooring, which minimizes fatigue of the levermen when they are forced to stand at the machine for long periods of time. The operating room is also provided with an acoustic ceiling extending down the side walls approximately twelve inches. The appearance of the room is also enhanced considerably by the steel casement windows glazed with plate glass. The lower sections of these windows open inward to provide ventilation without an irritating draft.

All of the relays are located in the tower and are arranged on two wooden racks in a room immediately below the interlocking machine. Relays are mounted on both sides of each rack, the porcelain terminals for the relay wires being located on panels near the floor.

The primary control relays are of the 60-cycle a.c. type, and all of the track circuit relays are located in the tower. These track relays have red and green indicating lamps, incorporated in the front end of the relay housing, these lamps being of great assistance in helping the maintainer to check the operation of track circuits. Because they are much cheaper, d. c. relays were used for all of the secondary control circuits, thus saving about 80 per cent in the total cost for relays. A 12-volt Exide storage battery furnishes energy for the d.c. relay circuits.

Teletype Communication

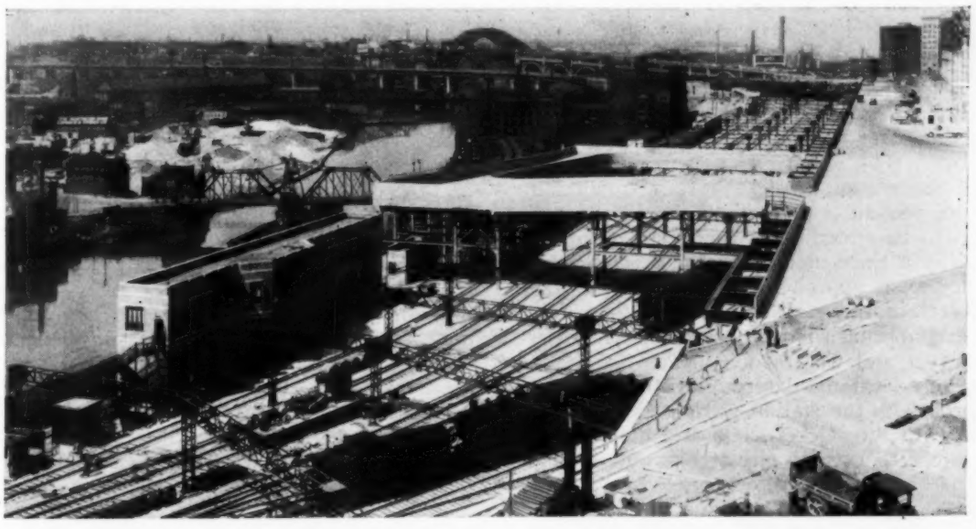
A teletype communication system has been installed for handling train announcing and coach movement orders. The teletype installation consists of 2 sending-receiving and 14 receiving-only tape teletypes. The sending-receiving machines are located in the telegraph office and the signal tower, while the receiving-only instruments are at the telephone information board, the Pullman reservation desk, the ticket office, the information booth, the West End yardmaster's office, the East End yardmaster's office, the crew dispatcher's offic, the bulletin board, the baggage agent's office, the subforeman's ofnce, the stationmaster's office, the express office and the mail room. Messages are trans-

mitted simultaneously to all of the receiving stations from either one of the two sending points, the second sending machine making a copy of the transmitted message. The sending machine in the tower is used for reporting the arrival of trains, the information giving the train and track number, e.g.,

TRAIN NO. 9 ON TRACK 2

TRAIN NO. 11 ON TRACK 15

The transmitting machine at the telegraph office is used for sending out advance information regarding the arrival of trains. The coach movement orders are handled by page teletypes, a sending-receiving page teletype being located in the telegraph office, and receiving-only bulletin cabinet instruments at the telephone information board, the West End yardmaster's office, the East End yardmaster's office, the car department foreman's office, the signal tower, the crew dispatcher's desk, the stationmaster's office and the subforeman's office.



Looking West From Ontario Street—Signal Tower (At the Left)—Ramp Drive to Mail Room Spanning over the Coach Tracks (in the Center)—Huron Road Extension (at the Right)

Telephone Train Dispatching

A dispatcher located in the station directs the train movements on the entire terminal area from Nottingham yard in the east to Berea and Linndale on the west, a district about 25 miles long. A Western Electric alternating current selector board with connections with 30 stations is provided for this service, 18 of these stations being located on the track platforms in the station, and the remainder in stations and interlocking towers at various points on the lines approaching the connections to the terminal track.

A color-light signal system provides intercommunication between the gateman in the concourse, the conductor on the station platform below, and the towerman, the purpose of which is to enable trains to get started quickly when all passengers are on board. Small red, yellow and green lights like those on a telephone switchboard are provided in a bronze plate on top of the marble stairway railing at each gateman's station in the concourse, a push button being located on the inside of the railing within his reach. An opal and green lamp case is located below on the platform for the guidance of the conductor. When the last passenger goes down the stairway the gateman closes the gate and pushes the button, which causes the conductor's green lamp to be lighted. After allowing time for the passenger to get aboard, the conductor pushes a button, causing a red lamp to be lighted on the panel in the tower and an opal light at the platform in the section in the direction the train is proceeding, oriented east or west of the axis of the station. When the train passes the first interlocking signal, all of the train-starting signals are put out automatically.

Power Supply

The 220-volt, 280 a.h. Exide storage battery for the operation of the switches is located in the west end of the basement floor of the tower. The cells are arranged on two shelves extending around the walls of the battery room. Lead strips are employed for the cell-to-cell connections, the terminal bolts being covered with black asphaltum paint. The end cells are provided with tap cables running to the switchboard in the room upstairs. The six-cell control batteries for the various local circuits are on a table in the center of the room.

A 4,400-volt, single-phase signal transmission line extends the full length of the electrified territory, namely, from Linndale at the west end to Collinwood at the east end. The normal supply source is at the signal tower but in case of a failure at this point, the 4,400-volt line is automatically energized from either end. The automatic switching equipment for accomplishing this was furnished by the General Electric Company. Single-phase power transformers of 1 to 1 ratio are located in the basement of the tower. Oil circuit-breakers, remotely-controlled, are located in the room upstairs on a small balcony just above the automatic switchboard.

Battery Charging Equipment

Two motor-generator sets are provided for charging the main 220-volt operating battery. These units use diverter-pole generators having an output of 32.5 amp. at 1,800 r.p.m. The charging panels for the 220-volt battery and also for the 12-volt control batteries are in the same room. This switchboard has five sections, and is featured by the use of special multiple-tap, plug-type receptacles for regulating the charging rate of the 12-volt batteries.

Lead-covered cable is employed for the underground circuits running from the tower to the various man-

holes at the groups of switches and signals. This cable is carried in Bermico fiber duct line encased in concrete and sufficient spare ducts are available to provide for future expansion. On the Cuyahoga Valley viaduct the cables are run in boxing constructed of creosoted pine and supported below the south edge of the structure by iron straps. The cables enter the tower through a manhole at the front and are carried in troughs to the terminals on the relay racks. An insulated joint is inserted in the lead sheath of each cable for the purpose of insulating the tower from any electrolysis current which the cable sheath may pick up. These insulated joints provide protection also in case any 3,000-volt contact wire comes in contact with any part of the cable system. The lead-covered cable was furnished by the Rome Wire Company, the Kerite Insulated Wire & Cable Company, Inc., and the Simplex Wire and Cable Company.

Parkway cable was used between the manholes and the signals and switches, and also from the tower direct to those functions located near the tower at the east throat of the station layout. Likewise, parkway cable with bootleg outlets was used for all rail connections.

The parkway cable was furnished by the Rome Wire Company, this company also furnishing the insulated wire used in the tower. The tower was built by the Hunkin Conkey Company.

Large Expenditures for Approaches

The ultimate plan for the approaches to the station contemplates four steam-road tracks with the addition of one or more tracks for short distances adjacent to the throat of the station yard, and four traction line tracks. In the present construction, the trackage has been confined to two tracks for each class of service, supplemented by a third steam-line track from British street in the west approach and from near East Fifteenth Street in the east approach, with a fourth track in the east approach from a point midway between East Ninth street and Central avenue.

The chief considerations determining the location of the west approach to the station were satisfactory connections with both the Nickel Plate and the Big Four, a minimum interference with city streets and a suitable crossing of the Cuyahoga river, the latter being the key to the grade line since it was desired to build a fixed structure and that entailed a high-level crossing, with the tracks on the channel span at Elevation 100. The west (or south) end of this approach was established in the vicinity of West Thirtieth street, where the Nickel Plate main line crosses the main line of the Big Four on an overhead bridge. From this point the new approach line extends almost due north in the middle of the block between Columbus road and Gehring avenue (or West Twenty-Second street), crossing the Cuyahoga river north of Riverbed street and then traversing a curve of about five degrees to the west throat of the station yard.

Although the two ends of the west approach differ but little in elevation, the high-level crossing of the river necessitated a grade of 1.48 per cent against inbound trains for 1,088 ft. south of the bridge and a 1.56 grade (not compensated for curvature) against outbound trains for a distance of 2,921 ft. The primary feature of the west approach is the bridge across the river and its approaches, a structure having a total length of 3,450 ft. and extending from the east side of James street to the west side of Franklin avenue. This structure not only provides the river crossing, but permits of unrestricted use of the land under the viaduct, served by nine streets passing beneath the structure.

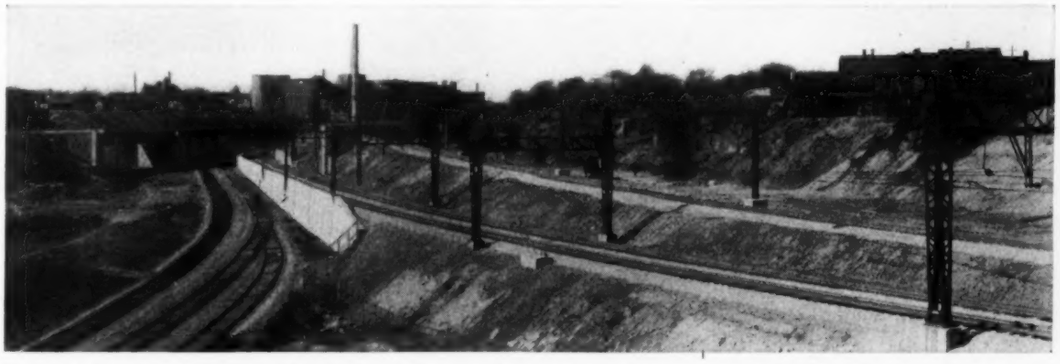
Grade Separation at the Junction

From the south end of the viaduct to the end of the approach, the line is in a cut from 11 to 30 ft. deep, which has been excavated to provide a four-track roadway, although the viaducts constructed to carry streets over the cut have been built to provide room for the eight tracks of the ultimate layout. As seen on the map, a rather elaborate track arrangement has been provided at the junction with the Big Four and the Nickel Plate to effect an almost complete elimination of crossing movements of the various types of traffic to be handled over the several routes. In fact, almost the only movement involving the crossing of opposing routes at grade is that of the inbound Nickel Plate passenger trains, which must move over the outbound terminal track for the distance between the Nickel Plate connection and a crossover between the inbound and outbound tracks.

While the construction of the west approach involved the vacation of considerable improved property

The Cuyahoga Valley Viaduct With the Terminal Buildings in the Distance

between Franklin avenue and West Twenty-Fifth street, the occupancy of that area was primarily residences and small business houses. Consequently, the problem was merely one of acquisition and clearing of the site for construction. In the east approach, on the other hand, the only feasible location was along the east side of the valley just west of Ontario street, Broadway and Pittsburgh avenue, which occupy the edge of the high land bordering the valley. Between Huron road and East Ninth street, this location was occupied by commercial and industrial buildings, while south of Ninth street it was occupied by local freight facilities and, in part, by the main tracks of the Nickel Plate. To clear this location for the terminal tracks, the Nickel Plate's main tracks were shifted to the west, but it was highly undesirable to do this with the freight house and team yard at East Ninth street because of their advantageous location on the high ground adjacent to Broadway. Accordingly, it was decided to replace them just east of the terminal right-of-way and to do this it was necessary to secure the vacation of Broadway between East Ninth street and East Fifteenth street and relocate Broadway via Orange avenue within these limits.



South End of the West Approach, from West Twenty-Fifth Street—Big Four Freight Tracks on Left, Terminal Tracks to Big Four Connection in Center, Nickel Plate Connection at Right, Nickel Plate Overcrossing in Background

Heavy Grading

The location of the east approach entailed heavy construction expense. From the throat of the station yard to Eagle avenue, the approach is in the hillside, while south of Eagle avenue to East Fifteenth street the line is in a cut averaging 40 ft. in depth. South of East Fifteenth street the construction of the remainder of the line was largely side-hill work with the excavation greatly exceeding the embankment.

It was necessary to carry five streets over the terminal tracks and to build three railway overcrossings on sharp skews. One of the latter was required to transfer the traction tracks from the east side to the west side of the steam tracks. The other two were needed to provide a suitable rail connection between the Nickel Plate's main tracks, located on the south side of the terminal tracks, and its freight houses and team yards at a higher elevation on the other side.

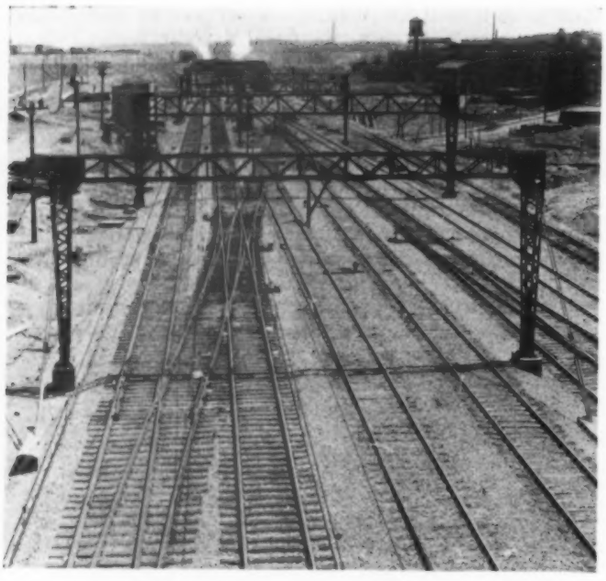
South of East Fifteenth street it was necessary to provide not only the required roadway for the terminal company's tracks, but also for three main or running tracks of the Nickel Plate which had to be moved southerly to make room for the terminal approach right-of-way. Throughout this distance, the terminal and Nickel Plate main tracks are substantially at the same elevation, but between East Thirty-Fourth street and East Twenty-Fifth street, it was necessary to provide a double-track incline connection to the Nickel Plate overcrossing into the local freight facilities east of the terminal tracks. This entailed rather extensive retaining-wall construction.

In addition to the heavy grading required in the two approaches, a large amount of earth had to be moved in preparing the site for the station. On the axis of the station, the original ground surface sloped from Elevation 90 at the Public Square to Elevation 33 at Canal Road, a distance of 900 ft., the slope being more precipitous near the easterly end of the station area, where the distance between the high-level and the low-level streets is less. The entire area had to be leveled to approximately Elevation 49, a task which entailed a considerable excess of excavation over embankment. The excavation amounted to 775,000 cu. yd., and this, added to 425,000 cu. yd. of excavation in the west approach and 1,340,000 cu. yd. in the east approach, made a grand total of 2,540,000 cu. yd. for the entire project within the limits of the terminal company's property.

Grading Methods

As only 125,000 cu. yd. of the excavated material could be used in embankments, it was necessary to dispose of 95 per cent of the excavation outside the limits of the work. Where the grading operations could be reached with tracks, the material was disposed of by train haul, but on some of the work, motor trucks were employed, the contractor making his own arrangements for disposal. In some instances, it was necessary to proceed with the excavation of through cuts within the limits of individual blocks. This resulted in the formation of isolated pits incapable, for the time being, of drainage. Dragline machines were obviously of marked advantage in such locations, although large-capacity shovels were used extensively in the work. The principal grading contractors were the Walsh Construction Company, the H. E. Culbertson Company, the Cleveland Excavating Company, the Hecker-Moon Company and the Herkner Motor Trucking Company.

Because of the preponderance of cuts, special attention was given to the matter of track drainage; in addition to the generous depth of ballast provided, as previously described, steps were taken to insure that water confined in the roadbed would be released. In each side ditch and between the two inside tracks, Armco and Toncan eight-inch perforated corrugated iron pipes were placed in trenches backfilled with gravel or broken stone. Manholes with grated top inlets were placed in the drain lines at intervals of about



East Approach, Looking South Toward East Thirty-Seventh Street

200 ft., to provide drainage in winter when the roadbed is frozen, for cleaning purposes and for connections to the cross-drains of 12-in. cast-iron pipes which cross under the tracks to a longitudinal main sewer having a minimum diameter of 15 in. The drainage system was installed by the Lowensohn Construction Company.

Many Structural Problems

The terminal project involved much that called for skill and ingenuity on the part of the structural engineer, for in addition to the special problems incident to the design of the air-right structures over the station area, involving loads of as much as 5,600 tons on a single 11-ft. 7-in. caisson, it embraced a large amount of bridge work. The most conspicuous structure is the four-track viaduct over the Cuyahoga valley, the primary feature of which is a three-truss through span 270 ft. long over the river. The rest of the structure includes one deck-truss span 140 ft. long and 29 deck plate girder spans of varying lengths up to 125 ft. The substructure consists of tall concrete piers, most of which are in the form of bents of three or four columns, joined at their tops by semicircular arches. With the exception of the three easterly piers and the two river piers, the substructure is supported on rather wide spread reinforced concrete footings resting on piles. The two piers supporting the river span have a rather unusual type of footing, being supported on rock at Elevation —98.0 by means of 10 cylindrical footing piers constructed inside of open caissons. As the top of these piers is at Elevation 86.65, the total height from rock to top is nearly 185 ft. The total weight of the structural steel in the superstructure is 18,500 tons, which was fabricated and erected by the American Bridge Company, which also supplied the steel for the buildings on the station site.

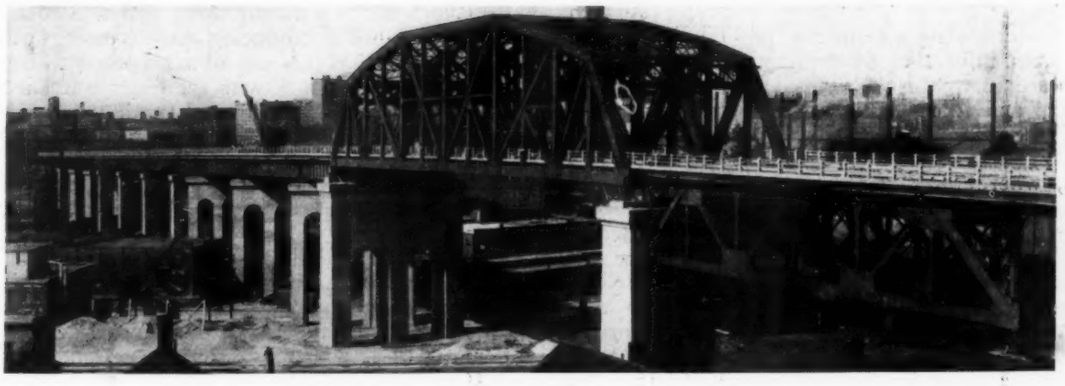
For the bridges carrying highway loading, reinforced concrete was employed in the superstructure where span lengths and available floor depth permitted. In other cases, steel girder or I-beam floors supporting concrete decks predominated. The railroad bridges are through and deck-plate girder spans, all of them on rather sharp skews.

The largest of the highway bridges is the Central Avenue viaduct. Constructed at the junction of Central avenue and Central viaduct, it has a width ranging from 148 ft. to 208 ft. The distance of 149 ft. between faces of abutments is covered by five reinforced concrete spans over six tracks and roadway space for the eventual construction of three additional tracks. The construction of these bridges involved many complications, chief among which were those introduced by the presence of sewers, water mains and other utilities, which had to be maintained in service during the progress of the work and adequately provided for in the completed structure. For example, at West Twenty-Fifth street it was necessary to depress the sewer and carry it through a concrete box culvert 10 ft. wide by 6 ft. 3 in. high, the footings for the piers and abutments being designed to span over this culvert. In general, water and gas lines and public service and telephone conduits were provided for in the floors of the bridges.

The Canal Road Structure

One of the most difficult projects embraces what is known as the Canal Road bridging, the structure that supports the east approach tracks where they pass over the angle in Canal Road near Ontario street. Because of the close spacing of the tracks, it was necessary to build this entirely as a deck structure, except for facia girders along the outer track, and use heavy floor beams, closely spaced, spanning on a skew across the full width of the street. On one side of the street, these floor beams rested on the top of a retaining wall, while on the other side they were supported on a rather complex system of loading girders through which the floor load was applied to columns erected just clear of the street line. Owing to the mass of utility conduits, sewers and other piping in the street, it was necessary to resort to open caisson piers for the foundations, and

Looking Southeast Over the East Approach Showing Eagle Avenue, Central Avenue and East Ninth Street Viaducts and Nickel Plate Overcrossing, with Broadway Viaduct in the Distance



The Cuyahoga Valley Viaduct and River Span

because of the large loads on individual foundations, it was necessary to build several of them as double piers, spaced 15 ft. center to center, with a heavy steel girder encased in concrete spanning between them below the street level.

The arrangement of the streets on the station site, whereby all the new streets are on the high level, introduced two auxiliary projects, namely, street connections between the high-level and low-level streets to replace such connections as formerly existed at or near the station site. One of these is the Columbus Road viaduct, which serves as such a connection between the high-level streets at Superior Avenue and West Ninth street and the low-level streets at Canal road and James street. The situation was complicated by the fact that tracks of the Big Four and Erie pass under the terminal tracks at this point, introducing the problem of avoiding a grade crossing with both groups of tracks, in addition to that of obtaining a satisfactory grade for the viaduct roadway. The result is a structure with a peculiar hook-shaped alinement, passing over the Erie passenger station, the Big Four tracks and James street and under the terminal tracks. It is a reinforced concrete deck-girder structure with a 46-ft. 7-in. roadway on two-column bents except for three spans of steel deck girders over the Erie station and the tracks.

Another connection between the high-level and low-level streets was provided east of the station in the form of the Eagle Avenue viaduct. This extends westward 1,798 ft. from Ontario street on a descending grade into the river flats, with a branch 948 ft. long on West Third street. It consists in part of a reinforced concrete trestle and in part of encased I-beam spans, with a deck-girder span over the Baltimore & Ohio tracks and Canal street. The main roadway embraces a vertical lift through-truss span on a grade over the Cuyahoga river, providing a clear opening of 212 ft.

By far the most extensive street viaduct construction incident to the project is that involved in the new street plan over the station area. This embraces 3,440 ft. of 100-ft. streets in the extensions of Prospect avenue and Huron road and 714 ft. of 60-ft. streets in the three new north and south streets connecting Prospect avenue and Huron road. These viaducts are of steel construction with column spacing and framing varied to meet requirements of track clearances on the lower level and the exigencies of the floor plan on the station level. The floor construction, which was used for both decks of the viaducts and also for the entire floor area over the tracks, consists of steel beams supporting a cast-in-place floor slab, while under the street steel was placed a Rackle precast concrete arch tile. To reduce heat loss and avoid condensation, the station floor was insulated with Celotex. It is of interest to observe that these viaducts have been built so as to be structurally independent of the steel framing of the building structures within the blocks. Steel expansion joints in the street deck have been carefully waterproofed and expansion joints in the station floor are covered with heavy brass strips.

The foundations were the source of construction difficulties and heavy expense, particularly for the large structures and those others which embodied heavy column concentrations. At the river bridge, as previously mentioned, the piers were carried to rock at a depth of approximately 100 ft. below lake level, while at the station site the piers under the Tower building were carried to rock 250 ft. below street level. The open-caisson or Chicago method was used in Cleveland for the first time in connection with this project. The Tower building required 87 of these wells, 4 ft. to 10 ft. 4 in. in diameter, and from 100 to 210 ft. deep below the track level, which is 40 ft. below street level. The sinking of these wells was accompanied with some difficulty by reason of the presence of ground water, the swelling of the clay and, in some instances, pockets of methane gas.

Retaining Walls

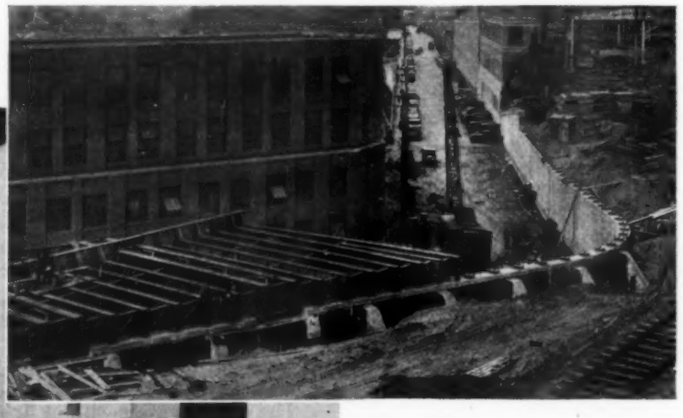
Owing to the fact that the present trackage on the approaches does not develop the full capacity of the

The Columbus Road Viaduct

right-of-way, it was possible to excavate cuts to a roadbed width adequate for the present trackage with a minimum utilization of retaining walls. However, there were many places where retaining walls were necessary and some of them are of much more than ordinary height.

The highest wall is that along Ontario street at the station, where the street is at about Elevation 93.0, the tracks at Elevation 52.0 and the bottom of the footing at Elevation 43.0. The footing has a width of 32 ft. A part of this wall is of the buttressed type, which buttresses designed to serve as the bases for columns for future buildings to be erected over the tracks. Other portions of the wall are of the counterfort type, having holes in the toe of the footing to permit the sinking of caissons for the foundations of future buildings. Elaborate provision has been made for the drainage of the filling behind the walls. A line of 24-in. vitrified sewer pipe was placed at the bottom of a back filling of stone, cinders and sand, the pipe draining into manholes from which the water is carried through the footings in 18-in. cast iron pipes. All expansion joints in the wall were provided with water-tight flexible diaphragms. This wall was built by the Walsh Construction Company.

Also at some points, where temporary walls were required, they were constructed of concrete cribbing furnished by the R. C. Products Company of Cleveland, while at certain other places where sub-soil conditions were bad and solid foundations very expensive, a cellular type wall of cast-in-place concrete with wide construction joints was employed with the expectation that it would settle and shift.



Above — A Construction View of the Canal Road Bridging

Left—Ontario Street Subway Construction, Retaining Walls for the Depressed Outbound Traction Track in the Foreground

Ontario Street Bridging

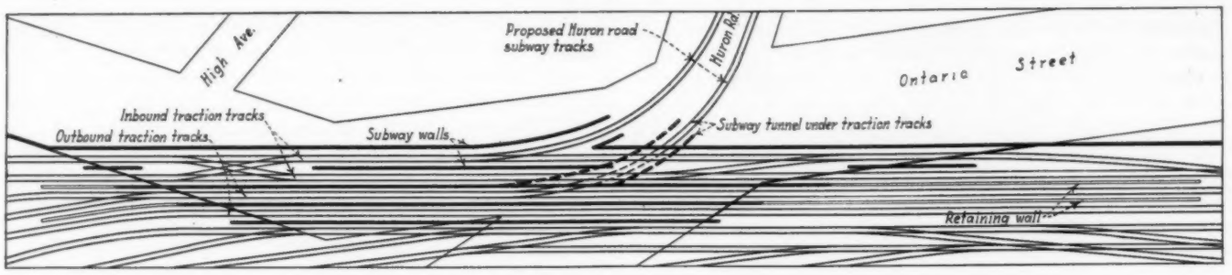
Intimately associated with the Ontario street retaining wall is a complex structure which serves the dual function of a retaining wall and a subway. It was required by reason of the fact that the traction tracks of the east approach occupy a triangular area about 860 ft. in length by 82 ft. in maximum width under Ontario street in the vicinity of High avenue and Huron road. A further complication was introduced by the necessity for meeting the requirements of a contemplated connection between the traction tracks and a future rapid-transit subway in Huron road and the supplementary requirement that this connection be effected without introducing grade crossings of opposing movements. To this end it is proposed to connect the inbound subway track with the outer traction approach track and the outbound track with the third traction track, but depressing this outbound track so as to pass under the two inbound traction tracks.

The solution of this complex problem took the form of four reinforced concrete box subways, each providing a minimum vertical headroom of 16.5 ft. and a normal clear width of 14 ft. for the four traction tracks, but at the location of a double crossover and at three turnouts the span was necessarily increased. In addition, the third traction track is depressed for a distance of 1,120 ft. by means of descending grades of 4.37 per cent and 3.65 per cent, respectively, to effect a sag having its lowest point at Elevation 31.74. From this point a fifth box subway on a curve was provided to carry the future outbound Huron road subway track under the two inbound traction tracks.

The various subway boxes are of such length that the roofs can serve as the support for a wall constructed along the west side of Ontario street to retain some 20 ft. of earth fill that occupies the space between the roof of the subways and the street pavement. Thus, the subway for the outer track is 780 ft. long and that for the inner or fourth track is 430 ft. The work was carried out by the Bates & Rogers Construction Company.

Heavy Work on the Approach Lines

One of the large collateral projects involved in the creating of the passenger terminal at Cleveland was that imposed by the need of suitable approaches for the New York Central trains. As previously explained, effective connections between the terminal and both the Nickel Plate and the Big Four were obtained by the construction of east and west approaches, having a total length of 3½ miles, but it was necessary to route the New York Central trains over the New York Central Belt Line, the Nickel Plate and the Big Four for considerable distances. No part of the route used by N. Y. C. trains involved the construction of any new line other



Subway Under Ontario Street, Subway Walls Indicated by Heavy Lines

than the 3½ miles of approach line of the Cleveland Union Terminals Company, but it did require heavy construction to provide additional main tracks to take care of the increased traffic to be developed, not only by reason of the use of this route by New York Central trains, but also because 5½ miles of the route along the Nickel Plate right-of-way is also being developed as one branch of the rapid-transit system that will have its terminal in the new station.

A description of this route, as it existed before the improvements were undertaken is as follows: Starting at Collinwood, the Belt Line, which was used exclusively as a freight line, crossed over the main passenger tracks of the New York Central from the freight facilities on the north, and extended south as a double-track line for a distance of 2½ miles to the Nickel Plate at Superior avenue. From this point southwest a distance of 2½ miles, the two lines, each with two main tracks, occupied a common roadbed to a point near East One Hundred and Seventh street where the Belt Line turns off to the south, crossing over the Nickel Plate on a skew bridge. For the remaining distance to the terminal connection, about three miles, the Nickel Plate had two main tracks in addition to one or more industrial leads. As a result of grade separation work completed in 1913, there were no grade crossings with streets from Collinwood to East One Hundred and Seventh street, but from this point to East Thirty-Seventh street, there were a number of crossings at grade.

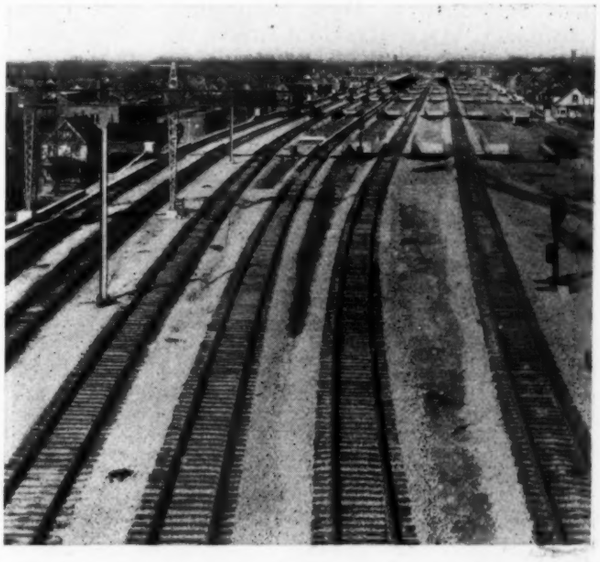
Provide Additional Tracks

The improvement work east of the Terminal embraced additional tracks at Collinwood for the transfer from electric to steam power and vice versa, a new double-track connection for passenger trains from the power-change tracks to the Belt Line at Coit Road, and an additional main track on each side of the two old main tracks of the Belt Line from Coit Road to the junction with the Nickel Plate, the two west tracks to serve as freight main tracks and the east tracks as passenger mains. From this junction westward, the tracks on the joint right-of-way have been virtually rebuilt to carry out the plan of providing for 12 main tracks, namely four New York Central, four Nickel Plate and four rapid transit. As now carried out, the tracks provided (numbering from north to south) are two N. Y. C. freight tracks, two N. Y. C. passenger tracks, two Nickel Plate main tracks and two rapid-transit tracks, in addition to a number of industry leads.

This arrangement of tracks continues to East Boulevard, where the grade of the two freight tracks separates from that of the other tracks so as to obtain the necessary difference in elevation at East One Hundred and Seventh street to enable the freight tracks to cross over the other tracks and continue southward along the Belt Line. West of East One Hundred and Seventh street there are six main tracks and a varying number of auxiliary tracks, but with provision for the eventual construction of 12 main or running tracks.

Between Collinwood and the junction with the Nickel Plate at Superior avenue, the work consisted essentially of widening the embankment and the extension of the structures for the street undercrossings. West of Superior avenue the construction was complicated by a considerable relocation of the tracks, such that at many points the tracks in their new locations would not fit the locations of the existing bridges, which were largely half-through plate-girder spans with I-beam floors encased in concrete. This entailed the renewal of many of the old spans, the concrete floors of which had to be wrecked by the use of explosives. All of the line from Collinwood to East One Hundred and Seventh street is on embankment with 17 street undercrossings, except for two short stretches near the west end of this territory which are in cuts and required three street viaducts over the tracks, which had to be entirely rebuilt. The Belt Line bridge over the Nickel Plate at East One Hundred and Seventh street also had to be replaced by a new double-track structure. As this crosses over nine tracks on a sharp skew, it has a length of about 500 ft., all of which is on a curve.

The work between Collinwood and East One Hundred and Seventh street involved 390,000 cu. yd. of fill, which was obtained from excavation in the cuts. Execution of this work imposed severe difficulties in providing sufficient trackage during the track changes to meet the needs of both revenue and construction trains. The grading work was done under contract by P. T. Clifford & Son,



Looking East Along the Joint New York Central-Nickel Plate Right-of-Way—Unused Space on the Right to be Occupied by Rapid Transit Tracks

the masonry work by A. Guthrie & Co., and the Walsh Construction Company, the structural steel by the McClintic-Marshall Company, and the track work by the Newhall Company.

An important feature of the project is a new joint New York Central-Nickel Plate passenger station at Superior and Euclid avenues. This is a handsome structure with red brick walls with limestone trim and a rough-finished slate roof, erected south of the tracks, with baggage and passenger tunnels leading to separate island platforms for the two railroads. The station, tunnels and platforms were built by the Sam W. Emerson Company of Cleveland.

Work West of the Belt Line Bridge

West of East One Hundred and Seventh street the new work involved not only the construction of additional tracks, but a complete grade separation program, the roadway being depressed to permit of carrying 10 streets overhead. Other features were a small terminal for the transfer from steam to electric power for Nickel Plate passenger trains at East Fortieth street, a local freight-terminal supporting yard between East Thirty-Seventh street and East Fifty-Fifth street, and the construction of the supporting yard and other trackage for the new Ohio Produce Terminal between East Thirty-Seventh street and East Fortieth street, the relocation of the Nickel Plate main tracks between East Fortieth street and East Fifteenth street and the reconstruction of the Nickel Plate freight houses and team-yards to clear the Terminal right-of-way. The grading west of East One Hundred and Seventh street, which involved over a million cubic yards of excavation, was done by P. T. Clifford & Son.

Improvements were also made on the Big Four between the West Twenty-Fifth Street junction and Berea, entailing a total net cost of more than $6,000,000. A primary requirement was 12 miles of additional main tracks, which provide four main tracks for the 3½ miles from the terminal connection to Linndale, the western end of the electrification, and three main tracks from Linndale to Berea, a distance of 7 miles. In addition, there is a fifth main track for a distance of about one mile from West Forty-First street to Clark avenue.

The improvements also embrace overhead viaducts for grade separation at West Forty-First, West Forty-Fourth and West Fifty-Third streets, the reconstruction of an existing viaduct at Denison avenue, and subways for undercrossings of West Boulevard and West One Hundred and Thirtieth street, and the extension and rebuilding of a subway at Linndale to provide for a large number of yard tracks and for a wider roadway.

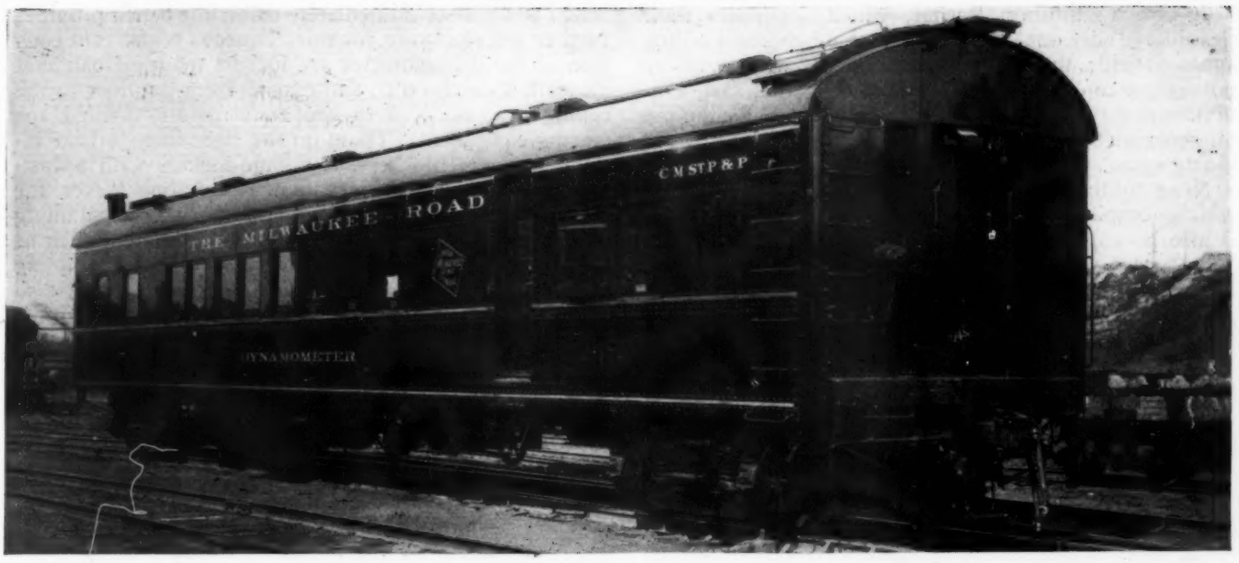
In addition to the electric locomotive facilities provided at Linndale, as described elsewhere, the Big Four has added 12 stalls to the steam locomotive enginehouse, a store room and office building, a water tank, a coaling station and a new three-point bearing turntable. An attractive new passenger station has been built at Linndale for the purpose of providing improved passenger service for the western portion of the Cleveland metropolitan area, thereby taking advantage of the necessity of stopping all passenger trains at Linndale to change power.

Looking North from the West Throat of the Station Tracks

History and Personnel

This project first received public notice in 1918 when A. H. Smith, late head of the New York Central System, appointed an engineering committee to investigate the plan which had been proposed for a union station at Cleveland, fronting on the Public Square. Following a favorable report by this committee, the plan was submitted to the city, accepted by ordinance enactment on January 1, 1919, and ratified by popular referendum on January 6. The participating railroads reached an agreement with the Cleveland Union Terminals Company to carry out this project in the fall of 1920, for which authority was granted by the Interstate Commerce Commission in 1921. Actual prosecution of the work of design and construction was commenced on January 1, 1922, with the organization of the terminal company's engineering corps under direction of H. D. Jouett, chief engineer. Graham, Anderson, Probst & White, Chicago, were retained as the architects. The staff which has assisted Mr. Jouett in the design of the various facilities and the conduct of the work includes: F. W. Badger, principal assistant engineer; W. L. Falvey, engineer of buildings; C. P. Marsh, engineer of structures; N. H. Suloff, engineer of construction; H. W. Pinkerton, assistant electrical engineer; C. D. Cronk, assistant signal engineer; F. L. Gorman, assistant engineer of structures; H. L. Bigelow, assistant engineer of construction, and L. E. Macomber, office assistant.

In a project as large as that embraced in the construction of this great terminal and prosecuted throughout a period of some eight years, it is obvious that the services of a great many firms of contractors would be enlisted, some of which have been mentioned on previous pages. In so far as the station area is concerned, the first large contract was that awarded to the Walsh Construction Company, Davenport, Iowa, for the grading of the site. This was followed by the construction of the foundation for the Tower building by Spencer, White & Prentise of Detroit, Mich., and New York, which firm later constructed the foundations for most of the other buildings in the station area and for the Canal road bridging and the Eagle avenue viaduct. The next large building contract was that covering the construction of the Tower building, awarded to John Gill & Sons, Cleveland, which firm also built most of the piers for the Cuyahoga viaduct. The station building and all the facilities entering into it were built under a general contract awarded to the Aronberg Fried Company, New York, and this company also built the Midland Bank building and the electric locomotive shop and inspection sheds, and completed the elaborate appointments for the Union Trust Bank in the Tower building. The Lundoff Bicknell Company of Cleveland was the general contractor for the other units of the air-right improvements, namely the Medical Arts, Terminal Garage and Builders Exchange buildings.



Dynamometer Car Recently Completed at the Milwaukee Shops of the C., M., St. P. & P.

New Dynamometer Car Placed in Service on the Milwaukee

Modern car, registering tractive force up to 250,000 lb., has unusually well-appointed living quarters for the crew

THE Chicago, Milwaukee, St. Paul & Pacific recently placed in service an all-steel dynamometer car, built at its Milwaukee (Wis.) shops and designed to register a drawbar pull up to 250,000 lb. and withstand a buffing shock of 1,250,000 lb. This road has operated a dynamometer car for many years and, with this experience as a background, it is believed that all undesirable features inherent in the previous car have been eliminated. Living accommodations in the new car have been made as complete and large as possible and ample locker room provided. The car is constructed throughout to withstand the severe service to which it will be subjected.

The car is 60 ft. long on the inside and weighs 132,000 lb., fully equipped. Four-wheel cast-steel trucks with 33-in. solid steel wheels are used, all wheels being equipped with clasp brakes, except the rear wheels of the front truck. The axle of these wheels is the source of motion for the paper driving mechanism.

The car body is of steel and thoroughly insulated. Since the car is used in freight service for the greater part and always coupled next to the locomotive, it was painted black with two aluminum 1½-in. borders, rather than the standard yellow color that is employed for the Milwaukee passenger trains. The external color scheme is similar to the tenders of this road's new passenger engines. On the interior, the sides of the dynamometer room and kitchen are battleship gray except the ceiling, which is painted old ivory throughout the car. The sleeping quarters, office and porter's section are finished in mahogany stain. The interiors of the wash rooms, lavatory, toilets and all lockers are finished in old ivory.

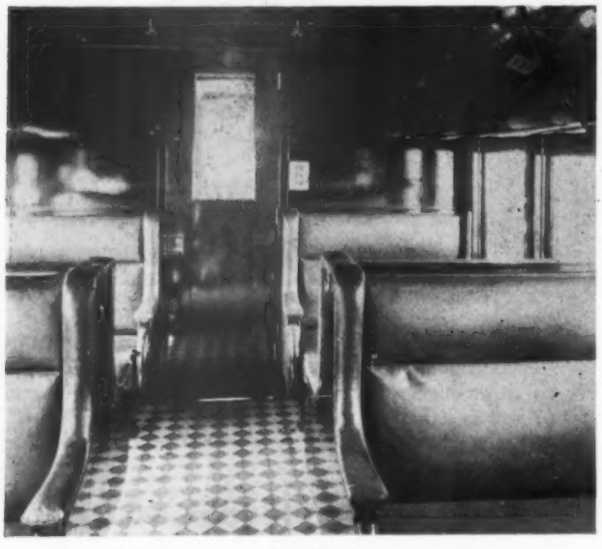
Ample Quarters for the Crew

The space provided for the living quarters of the crew occupies 42 ft. 7 in. and consists of the kitchen, porter's quarters, four berth sections, office, toilets and lavatories. A kitchen, 7 ft. 3 in. long, is located at the rear of the car and is fully equipped and well lighted. It is fitted with a standard car coal range. A large refrigerator that is iced from the roof is located in one corner. Other features include a Monel-metal covered sink, metal dust-proof coal box, Monel-metal covered work shelf, ample lockers and motor-driven exhaust fan. Suspended from the ceiling are two copper gravity water tanks with a capacity of 110 gal., and a connection to the hot water coil and copper supply tank of the range.

A porter's room, 6 ft. 6 in. long, is adjacent to the kitchen and consists of a lower berth with lockers above. Opposite this berth are a large linen locker and toilet with folding washstand and mirror above. In the passageway between the porter's room and the sleeping quarters of the crew is a hinged door that assists in keeping out the kitchen odors from the main body of the car. A door at the forward end of this room also assures greater privacy. The crew's sleeping quarters consists of four Pullman sections, thereby providing space for eight men. The seats are completely covered

with brown imitation leather, which facilitates their cleaning. Individual berth lights, table lights and ceiling lights provide the proper illumination, while ventilation is accomplished by a 12-in. electric fan, sash ventilators and two Utility exhaust ventilators. By the use of removable tables, this space is also utilized as a dining room.

Next to the crew's sleeping quarters is the office which occupies a space 13 ft. 7 in. long. In this space is also provided a toilet and a lavatory. The lavatory



Four Berth Sections in New Dynamometer Car

contains two Monel-metal washstands, two mirrors, wall lights overhead, hot-water tank and large full length locker, providing ample storage space for toilet articles and supplies. On the right side of the room is a computing table, 30 in. by 13 ft. 9 in., that is used for examining the chronograph table rolls and the writing of reports. The four windows in the side of the car immediately above this table provide excellent illumination for working on the rolls. Under this table at each end is a tier of drawers and two small lockers which are used for storing data, drawing instruments, blue prints, etc. Above the work table at one end is an emergency upper berth that may be used when required. Four lockers are above the other end. These lockers supply excellent storage space for the clothing of the crew.

Opposite the computing table is a flat top desk with large drawers at each end. The windows provide illumination for the desk, and immediately above them is a large book case with sliding glass doors. Artificial illumination is supplied by means of electric lights suspended from the ceiling, a row of lights with reflectors mounted on the wall above the computing table and two movable desk lights. Two 12-in. electric fans, sash ventilators, and two Utility exhaust ventilators provide proper ventilation in the work room.

Location of Equipment in Dynamometer Room

The dynamometer room occupies the forward end of the car and is 17 ft. 5 in. long. The chronograph table is located approximately in the middle of this room. In the left rear corner is an oak work bench with ⅛-in. steel top and a bench vise. A tool rack is provided at one end of the bench. A small steel tool box that is bolted to the floor immediately below the bench provides further storage space for miscellaneous tools. On each side of the dynamometer are lockers made of oak that measure 18 in. by 6 ft. and extend from the floor to the ceiling. These lockers are conveniently divided for storing equipment. Those on the right include four individual overall lockers, two gage lockers with adjustable shelves spaced every five inches, one locker for storing temperature recorders, and one locker containing adjustable shelves for miscellaneous equipment such as draft tubes, manometers, gage testers, coal-sampling jars, etc. The lockers on the opposite side are also equipped with adjustable shelves and provide storage space for paper rolls, brooms, shovels, lanterns, signal flags, oil, etc. A reel is provided on the end of this tier of lockers to support the 12-wire signal cable used between the dynamometer car and the locomotive. Additional lockers are built into the space immediately above the sliding end door and extend the full width of the car.

There are two seats, with cushions covered with brown imitation leather and with boxes below for storage, at each side of the chronograph table. Two of the seats are used by visitors and the other two by those taking observations. The observers' windows provide clear vision along the side of the train and may be readily removed by loosening thumb screws. A divided drop window slides into place when the portable window is removed. Immediately forward of the observers' seats on each side of the car are located drop leaf table shelves which are used while making notes and reading profile maps. An adjustable electric spot light is located in each observation window and used for locating mile posts, etc., at night.

Natural illumination of the dynamometer room is accomplished by two sliding windows, two swinging side-door windows, and the sliding end-door window. Three suspended ceiling lights and three wall-mounted lights with reflectors give excellent artificial illumination.

This room is well ventilated by the aid of two intake ventilators, two exhaust ventilators, and a 12-in. electric fan which is mounted above the sliding end-door.

Batteries Charged by Kohler Unit

A 1½-kw. Kohler farm-lighting plant, which is located under the work bench where it is protected and out of the way, is used to charge the storage batteries. The battery equipment consists of two sets of 225-amp.-hr., 32-volt storage batteries used separately which are hung in a single battery box below the car. The switchboard locker is located in the rear right hand corner of the dynamometer room and the circuits are so arranged that while one set is being charged the other may be used to furnish light and power. If both batteries should be discharged to such an extent that they could not be used, electric power may be taken directly from the generator of the Kohler unit. It is also possible to obtain electric current from the train line whenever the car is used in passenger-train service. Both battery sets are also equipped with charging receptacles that are used whenever the car is stationed at terminals where charging plants are available.

On the left side of the car between the dynamometer room and the lavatory is the heater room. It is thoroughly lined with galvanized iron and has double doors that open towards the aisle. The car is heated by a hot-water system, heat being obtained either by fire in the Baker heater or by steam from the train line which enters a water jacket at the rear of the Baker heater.

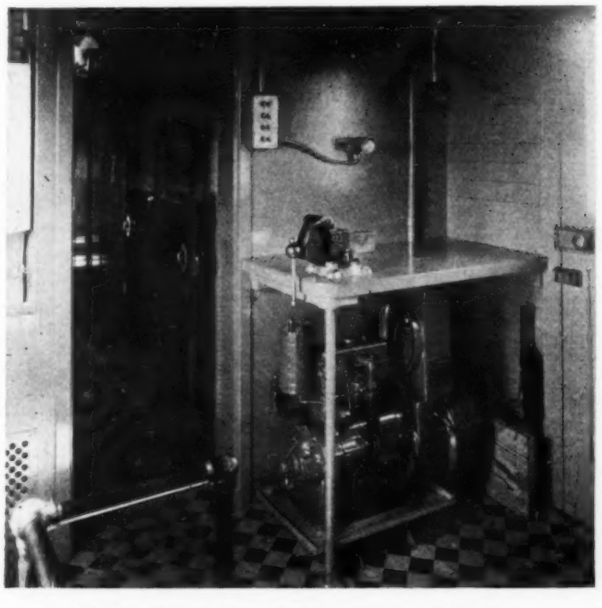
An overhead hot-water tank for the lavatory is hung in the heater room.

The weighing head, which is rigidly bolted to the car underframe, is located on the center line of the car immediately forward of the chronograph table. It is of the diaphragm type with a drawbar-pull piston at the rear and the buff piston at the front. The diaphragms are of rubber, and glycerine is used as the medium for transmitting the pull to the drawbar-pull indicator. The yoke in the weighing head gives a three to one ratio between the center line of the draft gear and the knife edge contacts at the center of the weighing head. The draft-gear connection and fulcrum in the vertical yoke between the drawbar and the weighing head have roller bearings. The weighing-head pistons are supported by suspension bearings and the pistons may be locked in central position by the use of jack screws.

The paper drive is taken from the rear axle of the front truck through an axle worm and worm wheel with a vertical shaft which extends up to the speed-change box that is located on the floor near the chronograph table. By means of this speed-change box, three paper speeds can be obtained from the axle drive, that is, ¼ in., ½ in. and 1 in. per 100 ft. of car travel. The speed-recorder motor can also be used to drive the paper, whether the car is in motion or not. By meshing the proper gears in the speed-change box, the paper may be driven from the motor at a constant speed of 7½ in., 15 in., or 30 in. per min., and at the same time have the speed recorder register the actual speed at which the car is traveling.

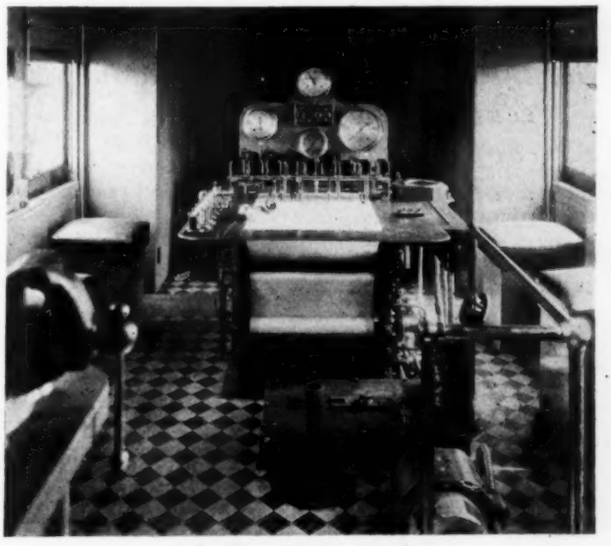
Chronograph Table—Other Recording Devices

The chronograph table roll is 22 in. wide. The bridge bar spanning the table supports all the recording fountain pens. The events recorded by the pens from right to left are as follows: Location line; cab records, such as throttle and reverse-lever position; drawbar pull; drawbar pull zero; integrator offset; speed; speed zero; six-second intervals by motor; one-minute line by clock; right side indicator; left side indicator; brake-pipe pressure; brake-pipe zero; one-inch paper travel.



Work Bench with Kohler Battery-Charging Unit Underneath

Base reference lines are necessary for the brake-pipe pressure, drawbar pull and speed. Fountain pens are also used to mark these base lines. At the forward end of the table is mounted the gage board which supports the clock, speed-record gage, duplex air gage, drawbar-pull gage, four signal lights and four relays. To the right of the instrument board and securely fastened to the table top are the integrator, drawbar-pull cylinder and speed recorder. Mounted on the right side of the table and close to the operators' chair is the selective



The Chronograph Table

switch box with marked individual switches for each electric circuit in the dynamometer room and those extending in the cable from the car to the locomotive. Telephones are used as a means of communication from the car to the cab.

On the left side of the table are six electrically operated counters, which are used to record the strokes of the air pumps, 100-ft. distance marks, integrator offsets, six-second intervals and each 100 lb. of coal delivered to the firebox. The coal is weighed in 100-lb. lots on platform scales mounted in the tender immediately over the stoker conveyor.

The speed recorder is the standard dynamometer-car recorder made by the Baldwin Locomotive Works. The motor used to drive the recorder is a 30-volt, 1,750 r.p.m., ¾-hp. constant speed General Electric motor. Mounted on the end of the armature shaft is a governor that is used to hold the speed as close to 1,750 r.p.m. as possible. Further adjustment is obtained by a face plate rheostat. The motor is also used to drive the paper when desired. A small lever at the right side of the table controls the speed recorder, the speed device being in neutral when the lever is at its neutral position. When moved back, the true speed of the car is recorded, and when forward, double the car speed is shown. At both the observation windows are button switches for indicating location points.

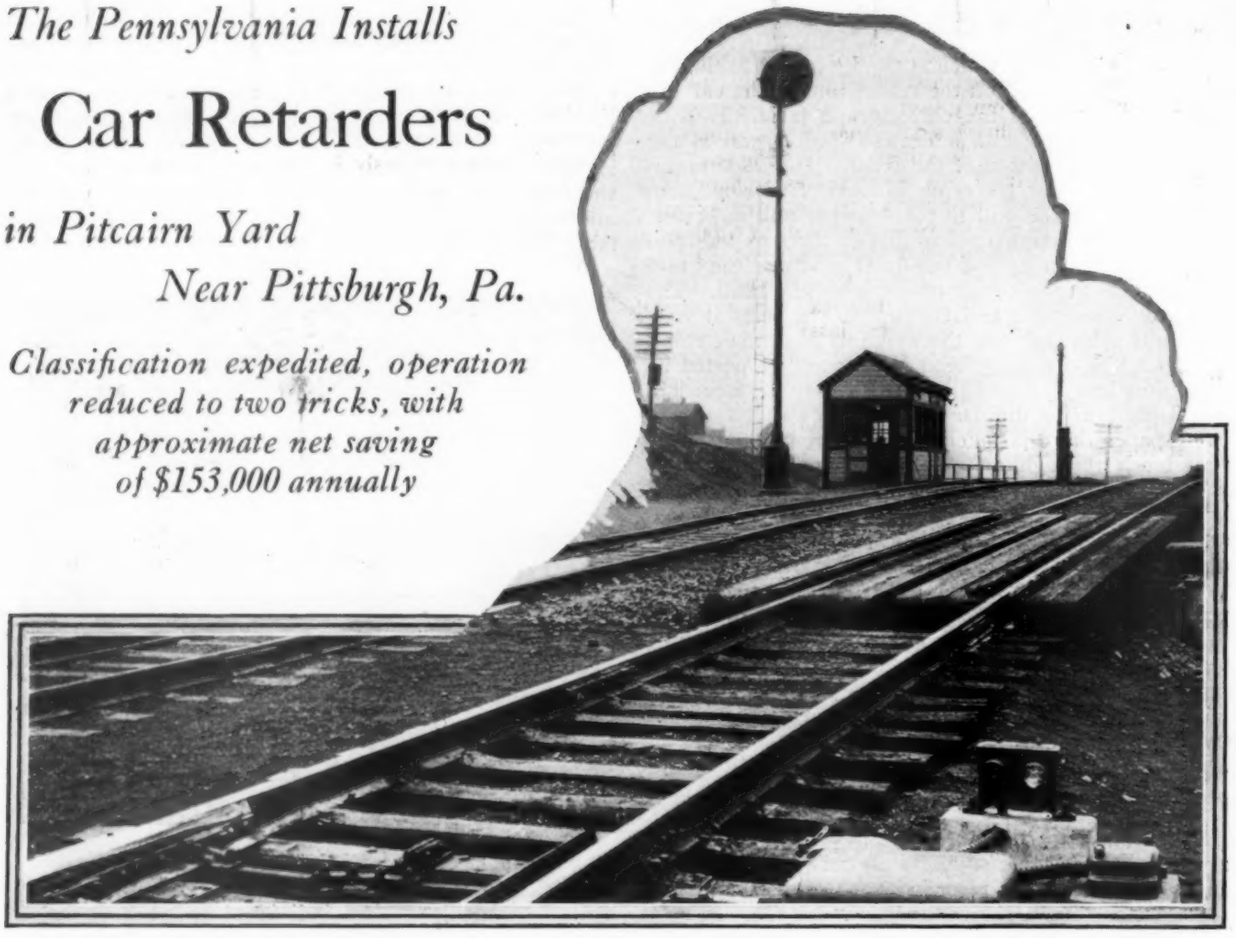
A removable trap door in the floor over the draft gear in the kitchen end of the car is used in connection with draft gear tests. With the door removed, the gear may be inspected and gages mounted to collect data on the action of the particular type of gear undergoing test at the time.

The Pennsylvania Installs

Car Retarders

in Pitcairn Yard
Near Pittsburgh, Pa.

Classification expedited, operation reduced to two tricks, with approximate net saving of $153,000 annually



View Looking Toward Hump, First Retarder in Foreground

SINCE November, 1929, car retarders have been in service in the eastbound classification yard of the Pennsylvania at Pitcairn, Pa., 15 miles east of Pittsburgh, Pa. As this yard was previously equipped with power-operated switch machines, an ideal opportunity is now afforded to study the cost of yard operation as formerly conducted with car riders, compared with the present method of using car retarders without riders. As will be explained in detail later, it may be mentioned briefly here that the operation has been speeded up, with the result that classification is now handled with two tricks, and the net saving in operating charges over and above interest and depreciation on the expenditure for retarder apparatus equals approximately $153,000 annually.

The yard includes 34 tracks with a total capacity of 1,700 cars, the longest track holding 68 cars and the shortest 17 cars. The length of the tracks is limited by the topography, as will be seen in the illustrations.

Changes in Track Layout

The yard was previously arranged on the ladder principle with five ladders. In order that it might be better adapted for retarder operation, and also to reduce the number of retarders required, the track leads were rearranged in six groups, five of which include six tracks each and the remaining group, four tracks. New No. 10 turnouts were used to replace the No. 8 turnouts. At the same time the grades were revised throughout the area including the retarders and switches as shown on the profile. A non-accelerating descending grade of 0.3 per cent extends from the clearance of each turnout on each track throughout the classification yard.

The switches in this classification yard had previously been operated by direct-acting, electro-pneumatic power switch machines controlled by a push-button control machine in a tower near the apex of the hump. The same type of power switch machines were included in the new arrangement, but the old push-button machine was removed, the switches now being controlled in conjunction with the retarders in three separate towers.

A total of 25 single-unit, double-rail retarders were installed in this yard. The throat of the yard lies in a deep rock cut, which restricts the layout so that some of the track groups start farther from the hump than others. This difference in the length of the leads made it necessary to use more retarders for some routes. For example, a car moving from the hump to any track in Group 1, 2 or 3 passes through a total of six single-unit retarders, while a car going to any track in Group 6 passes through nine single-unit retarders. A power skate machine is located at the clearance point on each track. The control machines for the retarders, switches and skates are located in three separate towers, each machine having control of a certain area as indicated on the sketch. The retarders, power switches, signals and control machines were furnished and installed by the Union Switch & Signal Company.

This yard is used exclusively for high-class, east-

bound traffic, about 90 per cent of the cars being loaded, the lading consisting principally of merchandise and manufactured products. The several western lines of the Pennsylvania from Cleveland, Detroit, Toledo, Ft. Wayne, Chicago, Columbus, Indianapolis, St. Louis, and Cincinnati, all converge into Pittsburgh. The eastbound high-class freight traffic on these routes is handled in scheduled trains each bearing a name as, for example, the "Cincinnatus" which leaves Cincinnati at 6:00 a. m., and is scheduled to arrive in Pittsburgh at 11:30 a. m., with delivery in New York the third morning out of Cincinnati. A great deal of this eastbound through traffic passes through the Pitcairn classification yard.

In addition to the through eastbound traffic from the western lines and connecting roads, Pittsburgh itself with all its great industries is an important originating point for freight traffic. Of the eastbound loaded cars classified at Pitcairn, about 55 per cent originate in the Pittsburgh area. This traffic is collected from the various industries and delivered to the receiving yard in trains operated on regular schedule similar to those arriving from the west, which all together total 16 trains daily.

In the first place, these trains must arrive on schedule in order to prevent congestion in the receiving yard, which consists of 13 tracks, the longest holding 80 cars and the shortest 15 cars, with a total yard capacity of 866 cars. This whole yard lies on an ascending grade of from 0.8 to 1.0 per cent which further adds to the difficulties, but cannot readily be changed on account of the topographical limitations.

As soon as a train arrives, the conductor delivers the bills of lading to an office at the entering end of the receiving yard. Then a "checker" checks these bills against the cars and sees that the bills are arranged in the order that the cars stand in the train, this checking being done at the average rate of 100 cars an hour. The bills are then delivered to the yardmaster's office where a switch list is prepared showing the number of the car in the train, starting with the first car to be pushed over the hump; the initial of the car; a designation as to whether the car is light loaded or heavily loaded; and last, the number of the classification track to which it is to be diverted. This list is typed on the sending machine of a Teletype system, the list being printed simultaneously in each of the retarder towers. While these operations are being done, car inspectors are inspecting the train. In the meantime, the humper locomotive has been coupled on, and at the end of a period of about one hour after the train arrives in the receiving yard it is ready to be classified.

The assistant yardmaster in charge of the humping operation is located in a small building at the apex of the hump. On his desk are small levers for controlling the hump signal, and below these levers are buttons for controlling air-operated horns located along the receiving yard, by means of which he can sound certain signals for starting or stopping the humping; these horn signals are of benefit particularly during foggy weather.

The entire receiving yard is on a grade of 0.8 to 1.0 ascending toward the hump and the approach to the hump is on about 2.5 grade for 250 ft. in advance of the apex. Therefore, it is highly desirable to prevent interruptions to the humping operations that would require the train to be stopped. Ordinarily the cars are pushed up to the hump at an average speed of about 3 m.p.h. As soon as the last car has gone over the hump, the locomotive is moved out of the way of the next train to be humped, in order that continuous operation may be assured. Sufficient locomotives are used to have following trains waiting just west of the apex of the hump ready to start operation immediately after the last car of the preceding train has been humped.

As the cars pass over the hump the "cutter" uncouples the cars into the various "cuts" according to the switch list. As explained previously, each retarder operator has a copy of this list and manipulates his switch and retarder levers to divert the car to the proper track and control its speed properly so that it leaves the last retarder at a speed that will not cause damage

View Showing Retarders on Leads to Groups of Six Tracks Each

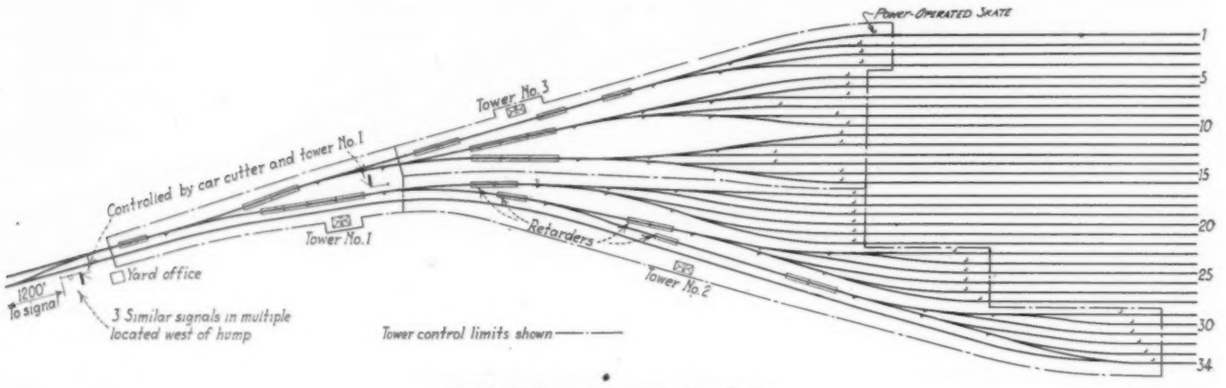
to other cars on the track. Track circuits are provided to prevent a switch being moved under a car. The grade of the classification yard tracks is such that the cars will not accelerate, after leaving the retarders. A telephone system with a transmitter and a loud speaker in each retarder tower and in the assistant yardmaster's office, affords immediate communication concerning the movement of cars.

Hand-placed track skates are used at the east end of the classification yard for the protection of clear tracks. Two brakemen secure the hand brakes on cars after they have been stopped at the east end of the yard by the use of the hand-placed skate. A skate is replaced when a track is "pulled."

Cars are pulled from the classification track at a predetermined time to permit trains to be prepared for handling over the Allegheny mountains on the eastern part of the Pittsburgh division. The departure operations consist of adjusting the piston travel, stopping of all train-line leakage, and testing, adjusting and repairing all retaining valves. A train is ready for departure about one hour after the cars are pulled from the classification tracks. On the average about four hours time elapses from the time a car arrives in the receiving yard until it departs in an eastbound train. Only 2 hr. to make connections with scheduled outgoing trains even when incoming trains are late. This result was made possible by the fact that the entire yard capacity, approximately 150 cars an hour, is available at all times, no delays being caused by waiting for riders, etc.

The use of the car retarders, together with the elimination of one trick of operation daily, has permitted a reduction of 76 men employed in the yard, which makes a total wage saving of approximately $444.95 daily. Also, the two-trick operation has permitted the release of four locomotives at a total saving of $40,-296 annually. In addition, the motor cars formerly required to haul the car riders are no longer necessary, with an estimated saving of $1,210 annually, or an estimated gross saving per year of $203,913. This gross saving is, of course, partly offset by interest and depreciation on the car retarder apparatus, increased cost of electric power and maintenance of plant over and above cost of old arrangement, all of which amounts to about $50,915 per year, or an estimated net saving of $152,998 annually.

The retarders, switch and skate machines are the electro-pneumatic type manufactured by the Union Switch & Signal Company, the compressed air for operation being secured from the compressors in the car



Track Plan of the Pitcairn Yard

30 min. are allowed for handling some of the through traffic from the time the train is scheduled to arrive until it departs eastward.

Comparison of Operating Results

With the previous method of operation, using 18 car riders on each trick, an average of about 600 cars was handled every eight hours. However, with the car retarder system, as high as 960 cars, in cuts averaging 1.4 cars per cut, have been classified in one eight-hour trick. When pushing at the rate of 2 m.p.h., 2.5 cars pass over the hump each minute, at which rate approximately 1,200 cars could be classified in one trick, if the traffic were available. The limiting factor in the yard operation is that the speed of the car when leaving the last retarder in the route must be low enough not to cause damage when striking other cars.

The increased speed of operation made possible by the new facilities has made it practicable to reduce the yard operation to two eight-hour tricks a day. In order to fit in with the scheduled time of arrival and departure of trains, these periods of operation are from 8:00 a. m. to 4:00 p.m. and from 8:00 p.m. to 4:00 a.m. Overtime has not as yet been entirely eliminated, but this feature is not excessive, and is not a daily occurrence. It is, of course, largely dependent on arrival of incoming trains. This arrangement has not delayed the departure of trains; in fact, it has made it possible

shops, about one-half mile away. The air lines in the yard are of wrought iron pipe, buried to a depth of 30 in. below the rail level.

In the area including the retarder layouts, the yard is built on solid rock so that all the trenches for the air line, as well as the cables, had to be blasted. The wires and cables were furnished by the Kerite and the Okonite Companies. The control battery consists of 12 cells of Exide Type-EMGO-7 battery with 120-a.h. capacity, being on a-c. floating charge of about 3.5 amp. from a Union rectifier. A cell of the same type of battery on floating charge is provided for each track circuit.

Although some of the traffic was diverted to other yards, the major portion of the regular business was classified in this yard during the reconstruction period, certain tracks being out of service at different times. In order to reduce the time required to install the retarders, each retarder was constructed complete with rails and ties in place at a location at the side of the yard. The retarder ties are 7 in. by 9 in. by 10 ft. treated oak. The entire layout was placed on a flat car by a crane and then set in place in the track. As soon as the ties were tamped up the track was again ready for service. The retarders in the main leads were placed on Monday, the light-traffic day, but the remainder were set without serious interference with regular yard operations.

Trains Like This Are Assisting Railways in Reducing the Operating Ratio

Superintendents at Minneapolis

Association considers train loading, terminal operation, safety, employment methods and allied problems

THE American Association of Railroad Superintendents held its thirty-seventh annual convention at the Nicollet Hotel, Minneapolis, Minn., on June 16-19 with approximately 250 operating officers in attendance. In addition to the reports of eight committees, the program included addresses by W. H. Bremner, receiver, Minneapolis & St. Louis, Minneapolis, Minn.; H. G. Taylor, manager public relations, American Railway Association, Washington, D. C.; E. F. Flynn, assistant to vice-president and general counsel, Great Northern, and E. H. McGovern, division engineer, Cleveland, Cincinnati, Chicago & St. Louis, Mattoon, Ill. At the annual banquet which was held on Tuesday evening, Carl R. Gray, Jr., vice-president and general manager, Chicago, St. Paul, Minneapolis & Omaha, acted as toastmaster, introducing Hon. W. F. Kunze, mayor of Minneapolis and the president of the association. All sessions of the convention were presided over by J. J. Franco, president, general superintendent transportation, National Railways of Mexico, who was accompanied to the convention by 25 operating officers of his railway and the Mexican Railway.

E. H. Harman, Jr. served as acting secretary in place of J. Rothschild who has been confined to his home for several months because of illness. The report of the secretary showed that 334 members were elected during the year and that the membership on June 1 was 2,317.

At the closing session of the convention on Thursday morning, the following officers were elected: President, C. E. Brower, general superintendent transportation, A. B. & C., Atlanta, Ga.; first vice-president, F. O. Whiteman assistant general superintendent, C. S. S. & S. B., Michigan City, Ind.; second vice-president, C. Forrester, general superintendent, C. N. R., Saskatoon, Sask.; third vice-president, Victor Parvin, general manager, A. A., Toledo, Ohio; fourth vice-president, F. O. Coleman, superintendent, M. & St. L., Oskaloosa, Ia., secretary-treasurer, J. Rothschild, St. Louis, Mo., re-elected; Chairman executive committee M. L. Hayes, assistant general superintendent of the transportation, M. P., St. Louis, Mo.

In an opening address W. H. Bremner, paid tribute to the operating officers of the American railways for the remarkable increase in efficiency attained in recent years. Mr. Bremner referred to the fact that the railways will continue to be the backbone of the transportation system of this continent in years to come and deplored the unfairness of the competition to which they are now subjected from subsidized agencies. He expressed the opinion that in view of these newer forms of competition, the railways may expect a stationary level of transportation volume in the near future. For this reason, he said, the only avenue for relief from the increasing demands of taxation, reductions in rates, etc., lies in increased efficiency of operation.

Edward F. Flynn Addresses Meeting

Edward F. Flynn, assistant to vice-president and general counsel, G. N., addressed the convention on Tuesday morning on "The Superintendent and Public Opinion." Starting with the statement that public opinion settles many problems, Mr. Flynn urged those present to use every opportunity to create a favorable public opinion towards the railways among those with whom they come in contact. He urged particularly that operating officers acquaint their patrons with the story of the development of railway service since 1920, with its improvements in schedules and regularity of delivery in the face of a reduction of more than 16 per cent in rates. He asked that they see that their shippers appreciate the extent to which the reductions in inventories which they (the shippers) have effected have been made possible by the improvements in transportation service which they now accept as a matter of fact. He urged also that railway officers familiarize themselves with the extent to which taxes are increasing and to tell their patrons of this also. He concluded with an exhortation to those present to do what they can to create a favorable atti-

tude among business men in general towards business conditions and reminded them of the fact that much of the present slackening in business is due to retrenchment in purchasing by those whose incomes have not been affected by loss of employment or reductions in wages and who, if they had continued to buy to their normal standards could have done much to maintain business.

Accident Prevention

A brief report on the reduction of accidents in the operating department was presented by a committee of which H. F. Milligan, superintendent, C. C. C. & St. L., Mattoon, Ill., was chairman, in which it was pointed out that safety, or rather the prevention of accidents, is now recognized as an integral part of every act that has to do with the transportation of freight or passengers, or the maintenance of equipment or roadbed.

The following statement shows the number of employees killed and injured on duty on the railroads of the United States, as reported to the Interstate Commerce Commission:

Year	Killed	Injured
1913	3,353	170,239
1923	1,866	148,146
1928	1,243	69,692
1929 (11 months)	1,247	55,783

The figures for 1923 are given to show the progress made since that time, in view of the goal of 35 per cent reduction set by the Safety Section of the American Railway Association for the succeeding 7 years, based upon the record of 1923.

Following the presentation of this report E. H. McGovern, division engineer, C. C. C. & St. L., Mattoon, Ill., presented a paper dealing with the general aspects of safety and referring to some of the methods employed on his division to control accidents in the maintenance of way department.

In discussing this report Victor Parwin, general manager, A. A., Toledo, Ohio, described a contest between different departments of his railway which was inaugurated in 1918 and which was so devised as to place the various departments on a comparable basis. Every tool house, roundhouse and other headquarters where men are employed is provided with a bulletin board on which there is chalked each morning the number of days since an accident occurred in that group, thereby keeping the subject of safety constantly before the employees.

Report on Train Rules

The report of the committee on Train Rules, of which C. A. Mitchell, superintendent, N. Y. N. H. & H., Hartford, Conn., was chairman, consisted of a brief resume of studies made by the committees on Signals and Interlocking of the A.R.E.A. and on Economics of the Signal Section, A.R.A. on the extent of and economies resulting from the operation of trains by signal indication, of automatic block signalling on a single and double track, on car retarders, on automatic highway crossing signals in place of watchmen, on automatic interlocking and on spring switches. The committee also submitted a table containing data on 32 car retarder installations as follows:

Summary of Installations

Railroads	16
Other corporations	2
Installations	32
Classification tracks	970
Operating towers	81
Car retarders	932
Power-operated switches	989
Power-operated skates	534

Discussion

In discussing the results secured from centralized dispatching, S. H. Shults, chief train rules examiner, C. B. & Q., Galesburg, Ill., stated that following the completion of such an installation between Red Oak and Balfour, Iowa, 26 miles, the movement of trains has been greatly expedited over this single track gap in a double track railway, while at the same time a marked reduction has been effected in the wages of block operators and the danger of collisions resulting from train crews overlooking orders has been reduced. Mr. Schults stated also, in reply to a question, that his road has eliminated switch lights on main track switches within 300 ft. of automatic signals.

In discussing an assignment given the committee to study the advisability of changing automatic signals but on which the committee made no report this year, F. L. Dodgson, General Railway Signal Company, traced the development of signal indications to indicate the principles underlying them and urged the members of the Superintendents Association to confine their study of this subject to the consideration of the information that they wanted their enginemen to receive and to leave to the signaling and engineering associations the problem of formulating the aspects through which this information could be conveyed to the enginemen.

Employment and Promotion

A statement of the basic requirements which operating officers should consider in the employment and promotion of those under their supervision was presented by a committee of which N. A. Ryan, superintendent, C. M. St. P. & P., Milwaukee, Wis., was a chairman, of which report the following is an abstract:

The first duty of a common carrier is to the public. Pleasant relations depend on the employees; therefore success or failure of their service depends a great deal on personnel. The choosing of employees from candidates for employment is one of the most important and far reaching of railway functions for the reason that in the railroad industry there is practically no limit to the extent of promotion and each new employee is a potential president. Therefore, one of the first essentials is to choose new employees who are best qualified for all rather than part of the requirement standards of the individual carriers.

A rigid physical examination is recommended for all applicants. The examination should be as rigid as that required by the United States military forces. The Wasserman blood test should be included.

Each applicant should be selected on the basis of being able bodied, big enough to do his work and not so big as to be in his own way or clumsy. His general physical requirements should be such that he will be equal to all physical emergencies that may arise in the course of railroading.

It is difficult to set down any hard and fast rule for different lines of employment and different local conditions make it necessary to vary the age requirements. Generally speaking, the man employed should be young when he first enters the service, for this promises to the carrier a span of active, efficent service that cannot be promised by a middle aged or older man. Age requirements that are acceptable to most carriers are: An applicant for engine service should be not less than 21 or more than 25 years of age; for train and yard service, not less than 21 years of age or more than 30 years of age; for telegraph and tower service, not less than 21 or more than 30 years of age; for other employees limits should be more or less flexible.

The judging of the applicant should include drawing him out as to his inclinations, such as his willingness to start at some inferior position with promotion in sight, developing, if possible, his view of his future, which in a measure answers the question as to whether he is industrious or lazy. His adaptability for railroad work should be developed at this time. He should not be declined for radical views expressed, provided they are consistent, for the reason that, without expression of such views, we would not progress. His mental poise should be looked into to see that he has an evenly balanced temperament that gives judgment under stress when exercise or judgment is required.

The man commencing his career with a railway company in any department should have at least a grammar school education through the eight grade. The idealistic point of view

would be that every new employee should be nothing less than a high school graduate, for it is much easier for employees to build on a foundation of education, which accrues to the benefit of the carrier.

Family history and personal habits should be investigated to a limited extent. If the applicant is found to have no background whatever, and is having family difficulties, by reason of poor morals, etc., he is undesirable and will make a very unsatisfactory employee. This investigation should also develop the applicant's leaning toward honesty. While there is no test for the examining officer to apply, he can usually judge closely.

Promotion

If the choosing of applicants for employment is done carefully, and the weeding out process is followed so that those developing undesirable traits are disposed of, the matter of promotion does not develop any serious problems. Owing to the fact that practically all promotions in the ranks on a railroad are determined on a seniority basis, everything else being reasonably equal, the officer has little to say about it. If it became a question of the officer deciding on the eligibility of an employee for promotion, the employee should not be considered unless he is a faithful workman, loyalty should rank as the next requirement, then personality which attracts most men to others, while personal appearance and health both go toward the manufacture of personality. Capability, capacity, truthfulness and dependability are required. Previous record should govern between men of equal other requirements, and where every item is about even, best feelings and results will obtain, even among officers, through following seniority as far as possible. The age problem in connection with promotion should be handled as it affects each individual case as no hard and fast rule can be applied generally. In cases involving other than seniority promotion, an industrious, loyal and faithful workman with a good record earns promotion and should be given it, when there is promotion available.

The discussion of this report was opened by W. E. Williams, manager personnel department, M-K-T, St. Louis, Mo., who characterized the hiring of men as the most important task of a railway officer, because of the fact that after an inefficient employee is once in service he can be moved only for a serious cause. "The only way to avoid having undesirable employees in one's service," he said, "is to refuse to employ them in the first place." He continued that the man responsible for another man's performance should be given the opportunity to select him. He deprecated the practice of allowing a clerk or other subordinate employees to select new employees, contending that this should be the task of a trainmaster or higher officer. Such an officer should constantly have men in mind ready for any emergency, thereby making unnecessary hasty hiring.

L. G. Waldrop, superintendent, L. & N., Nashville, Tenn., urged those present to take time to get acquainted with new men before the brotherhood chairmen do, stating that a little time so spent by a railway officer will do much to establish proper relations with a new employee and give him a proper attitude towards his job.

F. O. Coleman, superintendent, M. & St. L. Oskaloosa, Iowa, stated that all applications for employment on his division are passed on at monthly meetings of the superintendent with his staff and contended that the time was well spent because of the closer scrutiny given new employees.

C. L. Harris, superintendent, C. N. R., Virginia, Minn., urged toleration in the employment of men rather than condemnation for one who has made a mistake. To build up an adequate force of efficient employees, a superintendent cannot, he said, employ anyone hard and fast rule or measuring stick.

The Locating of Industries

A committee of which J. M. Hood, operating vice-president, A. C. & Y., Akron, Ohio, was chairman, presented a report on the locating of industry tracks and the manner in which the operating department can co-operate with other departments with the view to reducing further operating expenses. This report follows in abstract:

The Committee finds the best practice requires whole-hearted cooperation between industrial, traffic, engineering, operating and safety department officers where some, or all of these, have jurisdiction. The principal matters requiring forethought are the location of the turnout with reference to the predominating direction of traffic, to present or future addition tracks, to present or future maximum angle of divergence of frogs, and to the grades and curvature of the track or tracks and possible extensions thereof to permit the use of equipment now or likely to be assigned to the switching or movement of traffic to and from the proposed industry. Transportation officers should take advantage of this preliminary meeting with representatives of the proposed industry to cement future relations looking toward satisfactory switching and road haul service, looking out for obstructions to view, advising industrial representatives relative to local officers and employees of the railroad, how they can be reached and what the railroad's policy is on any matter likely to become important, such as regulations governing the handling of inflammables, the use of pits in the tracks, the use of locomotive cranes, demurrage and all similar regulations which, when understood, are helpful to all concerned, but when enforced in an arbitrary manner are a source of friction.

Transportation officers should collect all of the information possible relative to future expansion of the industry, offering their expert advice as to the location of buildings in such a manner as not to cripple future railroad service. When asked to assist in the location of the first industry in a given territory the last opportunity is offered to railway officers to decide whether the territory can best be developed by individual turnouts from the right of way, or whether an industrial belt is warranted. Often a suggestion of this kind will greatly increase the acreage available for industrial sites tributary to a given railroad and is heartily received by the real estate or industrial area development owner.

This report was accepted without discussion.

Highway Crossing Accidents

The subject of highway crossing accidents was dealt with in a report presented by a committee of which A. N. Williams, general superintendent, M. St. P. & S. Ste. M. was chairman. The report concluded with 12 recommendations which are presented below.

1. The installation of the flashing light type of signals with or without other arresting indications, offers the best form of automatic or manual protection.

2. Flashing light signals should be equipped with a small pilot light on the side of the lamps to indicate to train and enginemen, particularly to switching crews, that the protective device is in operation.

3. At certain points where there is considerable switching, flashing lights, should be controlled by an operator located in a tower or other place where a clear view of the streets is to be had, operating the flashing signals by push buttons during the switching hours. Such operation can be for 24 hours or any fraction thereof, and, in any case, the manual operation can extend only during the switching hours, the signals then being cut into automatic control.

4 Flashing light signals should be installed on both sides of the track or tracks, located preferably on the right side of the highway; although in some cases the location of the signals in the center of the street may be advisable.

5. Under certain conditions it is advisable that the light indications of flashing light signals be so arranged that they may be seen from either side of the signal, so that the driver of a car who has stopped opposite or beyond a signal will have the advantage of determining its indication from a signal on the opposite side of the track.

6. When signals protect more than one track, the fact should be indicated by a sign attached to the signal designating the number of tracks that the signal governs.

7. Ordinances should be enacted to prohibit parking within 30 ft. of a flashing light signal, so as not to obstruct the view of the signal.

8. Operators of crossing protective devices, or crossing watchmen should be given police power.

9. Operators of buses, trucks operating for hire, or other motor vehicles that can be considered common carriers, should be subject to the Interstate Commerce Commission regulations governing hours of service and periodical physical examinations.

10. Drivers of all motor vehicles should be 16 years of age and pass examinations for vision, color sense and hearing.

11. Advance warning signs should be installed and maintained by the state and local authorities at a distance of not less than 1,200 ft. from the track, and a greater distance if the conditions warrant.

12. The standard code of train rules whistle indication approaching highway crossing be changed to read—2 long—1 short blast, and 1 long, the last blast to be continued until the crossing is reached.

Discussion

In discussing this report, B. Blum, chief engineer, N. P., St. Paul, Minn., and a member of the recently organized A. R. A. committee on Highway Crossing Protection, pointed out numerous conflicts between the recommendations of this committee and those presented by the A.R.A. committee at the recent conference on this subject at Washington, D. C. and urged the revision of the committee's report with reference specifically to the following points:

Recommendation 1—The A.R.A. committee gives equal recommendation to wigwag and flashing light signals.

Recommendation 2—The pilot light is of doubtful value.

Recommendation 6—Ambiguous and should be clarified.

Recommendation 7—The 30-ft. parking limit should be increased to 50 ft. to correspond with recommendations approved by the recent Washington conference.

Recommendations 9 & 10—These are outside the province of the railways and should not be included here.

Recommendation 11—The location of the warning sign 1200 ft. from the crossing is too far back—400 ft. was approved by the Washington conference.

The association voted to revise the report to incorporate all the changes recommended by Mr. Blum and thereby bring the report in entire harmony with that presented at Washington. Following the discussion of this report, G. E. Ellis, secretary of the A. R. A. committee on Highway Crossing Protection, presented a number of slides showing various forms of highway crossing protection.

Heavier Car Loading

A committee, of which W. H. Haley, assistant general superintendent transportation, M. P., St. Louis, Mo., was chairman, presented a report outlining ways in which superintendents can promote heavier car loading among the shippers on their territories. This report follows in abstract:

Generalities and preachments will not promote the cause of heavier loading. They are helpful in developing a general knowledge of the subject and may be used to advantage in showing the cumulative effect, but experience has shown more definite methods are required to get results. Studies of specific commodities and of individual movements of these commodities provide the most effective means of demonstrating the benefits of better use of car capacity to shipper and carrier.

The man who approaches a shipper or receiver on the subject of the better use of car capacity ought to know all about the commercial and physical handling of the commodity involved. This requires a preliminary study of the loading and unloading facilities of the shipper, the amount of trackage serving his plant, the amount of switching necessary to serve him and whether or not his rates involve switching absorption, the amount of demurrage he has paid, a representative statement showing by car numbers and dates the lading in cars shipped or received by him and all other factors that surround his transportation necessities. Armed with such detailed information, the interviewer is in a position to meet any objections that may be raised, and in the majority of instances is able to point out direct savings to the shipper. He is also able to shatter the quite frequent complacent assertion of the shipper that he is loading as much as the circumstances justify.

An equally searching investigation is necessary to determine just what the railroad itself is doing with reference to loading under its control. Investigation has revealed that on company material and on import commodities loaded from docks railroads are failing to take advantage of their opportunities to load cars to capacity. In many instances shippers have not only expressed a willingness but a demand for more concentrated loads in order to reduce their own handling expense, and even in the face of such demands railroads continue to load their own cars indifferently. Avoidance of this on the part of the railroads can only be accomplished by an intensive study of their own practices. Such investigations will disclose that in many instances purchasing departments are using out-of-date shipping units, are disregarding the possibilities of arranging their orders so as to permit capacity loading and loading forces are left to their own pleasure with respect to loading cars. Equipped with information about these matters and with continuous supervisory direction, amazing results can be accomplished.

The stock explanation from both railroad man and shipper is that receivers will not accept heavy loads. Investigation has shown that this is largely a "bug-a-boo." While commercial and other necessities require limitations of the loading of certain commodities it has been found that in many cases where the shipper insisted he was loading lightly at the request of the receiver, this was merely an assumption on his part or a practice that had been established years ago, the original cause for which no longer existed. So deep-seated is this feeling on the part of some shippers that it requires direct insistence from the receiver to secure the change in practice. Education of the receiver is, of course, necessary, but experience has shown that it is not at all impossible.

Those railroads that have men directly assigned to the task of bringing about heavier loading and who are following the methods herein outlined are securing splendid results. It follows, therefore, that any railroad that desires to make progress in this important matter must have a department whose exclusive responsibility it is to study and promote the better use of cars through increased loading.

Receivers of freight can be divided into two classes: 1st. Those whose inventory requirements are met by a minimum carload each fortnight. 2nd. Those who receive multiple cars of the same commodity in 30 days. Obviously little success will result from working on consignees of the first class for they cannot load heavier without disturbing their inventory costs. Therefore, it follows that the multiple receiver is the one to whom we must look for results. How to uncover these "wholesale" users of transportation and bring such underloading as may be indulged in by this class of receiver to the attention of some one who can make an intelligent appeal for more efficient use of the equipment in their business is the question that confronts us.

In the solution of this question we should first consider how traffic moves over the rails, and what record is made of its transit. Every pound of freight that moves is started by one agent and stopped by another agent; therefore the agent appears to be the key man in any system that would intelligently further heavier loading.

If each agent was required periodically to report to his superintendent the names of all multiple users of transportation, both inbound and outbound, from his station, half the work would be done. All that remains then to do is give the information intelligent analysis and sympathetic handling.

Discussion

A. P. Stevens, district manager, Car Service division, A.R.A., Detroit, Mich., emphasized the importance of the yardmaster in increasing car loading by placing cars of proper capacity for loading at industries. Mr. Stevens then described the manner in which the car service division works among large shippers to promote increased loading, particularly in territories where competitive conditions are such that individual roads find difficulty in soliciting co-operation from the shippers. Mr. Stevens pointed out the frequency with which railway men can demonstrate to shippers how the heavier loading of their cars will help them reduce demurrage and switching charges. J. W. Walsh, superintendent, I. C., Memphis, Tenn., told of the aid rendered the local operating officers on his road by an A.R.A. representative who was assigned to study their loading practices and found many places where improvement could be made.

Heavier Car Loading

By H. G. Taylor

Manager Public Relations Department, American Railway Association, Washington, D. C.

The splendid records made by the operating departments of the railroads during the last seven years have been referred to so frequently that they are in danger

of becoming commonplace and their full significance discounted. It should not be forgotten however, that the present financial condition of the railroads of this country has been made possible by the efficiencies and economies realized in less than a decade. If operation today were on the basis of 1920, scarcely a railroad in the country would have had any net income in 1929.

In the face of continuing high costs, with actual increases in wages and taxes, the railroads have but one alternative for preserving their net income and that lies in effecting further economies. Competition of motor vehicles, pipe lines and other agencies of transportation will absorb a considerable part of the increase in gross revenue in the next few years. The relocation of industries and the decreasing trend in population likewise discourages hope of large increases in gross revenues. It follows therefore, that the carriers must rely on further perfecting of their methods of operation to reduce costs and fully utilize existing capacity. The operating ratio needs to be watched as never before.

The possibilities for further efficiencies are by no means exhausted. You superintendents are the key men in the situation. You have the responsibility for leadership and supervision which will stimulate the morale of the organization and furnish the necessary ideas for improvement. As practical and experienced men, you naturally desire to concentrate on those methods which promise the largest results. May I direct your attention to the report of the committee on heavier loading and urge you to give it your most careful study? No feature of railroad operation is so full of possibilities as is the more complete utilization of existing freight car capacity. Vice-President Gormley of the American Railway Association has estimated that by increasing the average of carload traffic by one ton, the railroads of the United States in one year will add one hundred million dollars to their net income. What other element in operation promises such rich return?

The special commodity loading statement of the Car Service division has just been issued for 1929. It discloses that the average loading of all carload traffic in this country for that year was 35.5 tons per car. This is an increase of 0.5 tons per car over 1928. To the casual observer this sounds like a meager improvement. That half-ton increase, however, means that if the tonnage of 1929 had been handled on the average loading of 1928, it would have required 487,700 additional carloads. These 487,700 carloads of freight represent 10,247 trains. The average haul of all freight in the United States in 1929 was 318 miles. On this basis 155,145,000 loaded car-miles and 3,258,000 train-miles were saved. The saving in empty car-miles is a little difficult to secure but it is obvious that it represents a very substantial element. Those are staggering figures and yet they will withstand analysis.

The commodity loading statement to which I have referred merits the most careful scrutiny. It reveals the standing of the railroad you represent with reference to the loading of major commodities. I can cite only one or two examples indicating the sort of story it tells. For example, it shows that one road had an average loading of wheat of 42.4 tons while a competitor in the same territory had an average of 43.5 tons. If the road with the lower average had loaded to the basis of its competitor it would have saved 950 carloads. If it had equalled the loading of another road operating in the grain territory, which had an average of 48.5 tons, the grain which it actually handled would have been loaded in 4,724 less cars. Another carrier in the same territory, if it had reached an average of 48.5 tons, would have carried its tonnage in 5,016 less cars. Two carriers serve an iron ore territory. There is a difference of 8.9 tons in their average loading. If the road with the low average had equalled the better loading of its competitor, it would have carried its tonnage in 68,400 less cars. These are but scattered illustrations of what may be found all over the country.

The response of shippers to the request for the better use of cars has been splendid. Numberless instances have been developed through checks made by the Car Service division and by the individual railroad showing that the shipper benefits equally with the railroad. For example, a large rubber company serving New England recently agreed to increase the loading of its raw rubber materially. After an experience of several months under the new loading an officer of the company expresses gratification over the improved service and indicates his surprise at the great reduction in demurrage brought about by the handling of less cars into his plant. Another large industry in the Middle West, after co-operating in the campaign for heavier loading, has indefinitely postponed an expenditure of approximately $65,000 for increased track and terminal facilities.

Railroads should give the closest attention to the loading of company material. Checks have revealed that the carriers' own records in this respect are no better than those of the shippers. Lack of supervision and attention has permitted practices to develop which seriously impair the efficiency of car units and set a poor example for the shippers. The general manager of one large railroad, appreciating the importance of this matter, has issued an order that no underloaded car of company material shall leave the point of loading without his permission. The loading of company material on that railroad has shown marked improvement.

The opportunity for mutual benefit in this matter of heavier loading makes the campaign a splendid vehicle for the further development of good will between shipper and carrier. Armed with information which indicates that by heavier loading of his cars the shipper can realize substantial savings in demurrage, loading or unloading, switching and general handling costs, the railroad man is in a position to win the confidence and sympathetic interest of that shipper. Without adequate service and economic operation, all the ballyhoo and high pressure propaganda in the world will not produce correct relations between the railroad and its patrons. In the present far-flung battle line of transportation human contacts are more difficult than ever but have lost none of their importance. Every opportunity for establishing those contacts therefore needs to be utilized. Heavier loading affords one of those opportunities.

Superintendents' Cost Data

The data which a superintendent should have at hand to enable him to know and control his costs was discussed in a report presented by E. H. Harman, assistant to general manager, Terminal Railroad Association of St. Louis, which read in part as follows:

Owing to the many sources from which charges to operating accounts emanate and the delay which, of necessity, occurs in the receipt of these data, it is impracticable to compile a complete and accurate report of daily costs by primary accounts by divisions. But the maintenance of a close watch over the chief variable items of expense on a unit or unit cost basis, is important for effective control and for this purpose definite knowledge is essential, with guesswork eliminated. Each superintendent should be placed in a position where, by daily study of his reports, he should be able readily to ascertain the "high spots" and "weak points" and to determine what phase of the operation is slipping, which knowledge should enable him to direct the work of his subordinates into right channels, to produce quick and effective results.

On lines where statistical staffs are not already established on divisions or districts, it may be considered that daily reports are not necessary for many items of expense such as agents and operators at small stations, permanent maintenance of way forces, etc., that generally do not change from day to day to an extent that would warrant the compilation of daily reports of the expenses involved, but proper control may be exercised over such costs by the use of monthly statements supplemented by special reports in cases of any unusual expense being incurred. On such railways it may be considered that the major variable items of expense may be suitably controlled by the use of daily reports of train performance, operations at the more important yards and freight stations, and such special operations as ballast pit loadings, extra gang work and work train service.

In the case of train performance, reports prepared on a unit basis may answer the purpose as well as if compiled on a money basis. Daily statements prepared from the information on despatchers' train sheets, covering the operation of each individual train, showing power, loading, movement, and production, can be checked in a superintendent's office against the potential operation that the superintendent establishes as generally possible of attainment. Any individual operation that departs from the standards so established by the superintendent can be made the subject of special investigation.

Statements of the operations at the more important yards and freight stations can be prepared on a money basis. For such yard operations, daily reports can readily be compiled by yard staffs that will show the number of cars received, forwarded, loaded, unloaded, weighed, etc., the time worked by locomotives, wage costs and such averages as cars moved per engine hour, wage cost per yard engine hour, and wage cost per car moved.

Daily reports can also be made of the work performed by freight office and warehouse forces at the more important freight stations, that will show the amount of business handled, inward and outward, with costs per ton for office expense, shed staffs, team track employees, etc.

Some railways have somewhat more extensive daily reports, giving such information as, in connection with freight train operation, speed per hour, gross ton miles per train hour or per crew hour, cost per train hour or per crew hour, and cost per 1,000 gross ton miles, for the date and also accumulated for the month to date, divided as to local and through freight service, also loaded car miles, gross ton miles, and net ton miles for that date and accumulated figures for the month to date covering total freight service including mixed and special. Such railroads also provide daily statements covering the general cost of operations, grand total expense for the date, total expense to date for that month, earnings—freight, passenger and other—for the date, and total earnings to date for the month and cost of transportation ratio for the date and to date for the month, with periodical amplification of this report to itemize the grand total of expenses to date for the month.

Many roads also use daily situation reports, generally made by the chief dispatcher, showing the total number of loads and empties moved in each direction during the previous 24 hours, total number of tons of freight moved, car situation for the division in general, movement of all local freight trains over the division, time crews called, time trains departed, and time of arrival at terminals, total time on duty, time of departure of all passenger trains from originating terminals and arrival at destination terminals, with explanation of any delays, also all overtime made by switch engine crews.

So far as the members of this committee have ascertained, the most complete system of daily cost reporting to superintendents is in force on the Missouri Pacific. (See *Railway Age* of May 24, page 1247.) There a standardized set of daily running records has been adopted, which place before the superintendent daily information covering each phase of the operation, in organized form. The forms for these records are printed, numbered and indexed. Each superintendent keeps them in proper order, in a binder, and the figures are entered each day by his secretary.

This report was accepted without discussion.

Motor and Airplane Competition

Two subjects were assigned to a committee of which M. F. Steinberger, manager highway transportation, B. & O., Baltimore, Md. was chairman as follows: 1—The growth and effect of motor bus, truck and airplane competition; 2—The problem of local passenger train operation.

The committee presented detailed data showing the growth in the number of buses and trucks and the corresponding extension of improved roads throughout the United States and Canada. It also showed the downward trend of railway passenger travel in recent years and presented reports from foreign countries, particularly Sweden and Italy, to show that the same trend was evident in foreign countries.

In discussing the motor truck, the committee stated its belief that the permanent field for this vehicle is within terminal areas and within a radius of 100 miles of those areas. While admitting that certain special commodities are moved longer distances, the committee secured no proof of the economic justification of the use of motor trucks for such transportation. The committee also stated that the motor truck can seldom be substituted for local freight trains because these trains handle both carload and less-than-carload business and if relieved of the latter traffic, they are still required to do the carload switching.

With reference to airplane competition, the committee presented voluminous data relative to the number of planes, the mileage made and the points between which they are in regular operation. In its investigation of local passenger service the committee stated that if a line is paralleled by a hard-surface road and the business is so light that no rail conveyance is necessary it should be handled by motor coach and rail service discontinued. If on the other hand, because of express and mail requirements or because the line contains a number of stations not reached by the railway, the rail motor car should be employed where grade conditions and the work to be done are within the ability of such a car, this, of course, being on the assumption that the traffic is of sufficient importance to justify any service.

The committee also discussed briefly the use of containers and consolidated cars for l.c.l. freight, drawing the conclusion that in so far as the use of the present type of container is concerned it is essential that they be handled by consolidating companies, either subsidiary to or independent of the railways. The committee also pointed out that an unbroken movement from a shipper's door to a receiver's door is possible in less than 5 per cent of the shipments handled.

The discussion of this report was confined mainly to a statement regarding the economies from the substitution of bus and truck service for trains on light traffic lines. A representative of the Central Railroad of New Jersey reported that that road is saving $25,000 per year by this means on a 22-mile branch line, while on another line a truck operation is now paying its way without reference to savings resulting from the elimination of trains.

A. E. Pistole, superintendent, T. & P., Big Springs, Tex., described the subsidiary motor transportation company which has recently been organized by his road to operate in Texas in conjunction with freight train service to provide storedoor delivery by 9 o'clock the following morning for distances up to 200 miles (described in *Railway Age Motor Transport Section* of May 24, page 1268). By this means he stated that the road is finding it possible to arrest the inroads which private trucking companies were making in its business and hopes eventually to regain a considerable portion of that which had been lost.

Interchange Car Inspection

Three subjects were assigned to a committee, of which A. G. Peck, general agent, M. K. T., Kansas City, Mo., was chairman, as follows: The Joint Operation of Terminals, the Advantages of Long Engine

Runs and Handling an Increasing Traffic without a Corresponding Increase in Terminal Facilities.

The Joint Operation of Terminals

If the principle of a union station is correct, the principle of a joint interchange yard is also correct if operated under proper agreements. It is true that it is possible to attempt to serve too many lines, or to handle too great a number of cars in one of these terminals, or the distance between the main train yards of some of the lines may make the haul too long. At such places joint interchange yards on two different sides of a large terminal, one serving five or six lines, and the other the remainder of the roads, can be made a success. Where there is a heavy movement of nearly trainlot or transfer engine loading between two lines, this interchange can, of course, be made much more speedily and economically direct.

The other type of joint operation, and possibly the one that the proponents of this subject referred to, is where the yards of two more lines are so situated adjacent to each other as to make it feasible to operate them jointly. We know of a considerable number of points where, by throwing two, three, four, or five yards together and operating some of them for inbound business for all lines, others for outbound business for all lines, and one possibly for industry business for all the lines, the business is greatly expedited.

In our investigation, we found places where a large number of industries are located on a main line on one side of the city in which three or four engines were attempting to work at the same time. By throwing all of this work into one assignment and stationing an engine there permanently, the industry is only disturbed once per day instead of two, three, or four times, while the cars are handled and pulled more regularly and often.

Also, often by a slight rearranging of schedules of inbound and outbound trains, the capacity of yards can be increased 50 to 100 per cent, while, if the arrivals and departures are spread over a longer period it is easy to see how capacity is increased. This principle also applies to either inbound or outbound traffic. In other words, instead of having five or six sections of trains following one another closely, yard capacity will be increased by spreading them.

Too often opportunities to operate jointly are foregone because one or more of the large lines insists on interest and taxes being divided so that the smaller line, or lines, have to bear so large a part of the burden as to make the joint operation uneconomical for them. In other words, such a demand crushes the smaller lines before they can get started, whereas the larger lines should see they have to pay these costs anyhow, and if they can get the smaller lines into the organization, the handling will be improved and the operating costs decreased for both without adding to the interest and tax expense of the larger line.

Advantages of Long Engine Runs

There is little to be said in favor of this procedure without running trains at high speed. We find that some lines are running certain freight trains at speeds of approximately 60 miles an hour and are changing engines at division points 125 to 130 miles apart in 10 to 14 minutes. These roads are running certain engines from 700 to 1,125 miles without working on them except in case of accident and have proved to their satisfaction that this does not hurt the machinery.

Admitting that freight trains can be run sixty miles an hour and that locomotives can be run 1,000 miles with ordinary oiling and inspection, let us take as an example the distance between Chicago and New Orleans—900 miles, and accept a speed of 50 miles per hour. An engine and train would require 18 hours to make the trip. A crew can certainly work six hours, or long enough to run 300 miles, and three crews could therefore handle the train from origin to destination terminals. In a 30-day period, assuming a single engine could run continuously at 50 miles an hour and haul 60 cars, it would make 40 trips and handle 2,400 loads. Then take another engine handling 80 loads and running continuously 30 miles per hour. This engine could only make 24 trips and would handle only 1,920 loads in the 30-day period.

We are prone to accept the principle of "take all you can haul," because it has always been so. But a new era is with us—the public wants high-speed service, and the fact that some lines are running these fast trains indicates that we may have been wrong from an operating viewpoint. At least this is what some of us believe, and we feel that the example given above is worthy of thought and trial.

It is true that the trainmen's expense would be increased on the high-speed train because of the method of payment per mile, but there would not be a great increase in fuel expense. Theoretically, at least, if long runs could be established, there would be a great saving in enginehouse and intermediate terminal expense.

Great accomplishments have been achieved in the extension of long runs and the development of the main tracker principle. In order to get the maximum results from this principle, engine tanks should have capacities of 15,000 to 18,000 or 20,000 gal. of water and 20 to 26 or even 30 tons of coal, or, where oil is used, from 3,000 to 5,000 gal.

The principle of long runs and main tracking between points 300 to 600 or 700 miles apart has been worked out very successfully between points where the density of traffic is sufficient to make it possible for the originating terminal to make up one or more trains a day for or beyond the destination terminal, and by holding the business for each of these terminals and making trains up solid for the destination point so no intermediate switching needs to be done. It is found that the economy of this practice is considerable and the final improvement of the service when considered from point of origin to destination is much improved. When the business is not sufficient for a full train to each of the destinations, it can be consolidated and run to a diverging point.

Water tanks and fuel stations should be available from the main line to conform to the main tracker idea and if extreme high speed is desired, inspection and oiling should be done while taking fuel and water.

Where engines are changed or the tonnage rating changed and cars added to or taken from trains, the switch engine can take the caboose off the rear while the outgoing engine can have the cars to be added coupled on to it and back on to the train; if cars are to come off they should be on the head-end so that they may be cut off with the inbound engine in order that only one coupling will be necessary. Car inspectors can be started from both the front and rear of the train the moment it stops. The above was done in the case referred to where only 11 minutes were consumed from the time the inbound engine stopped until the outbound train was moving on its journey. In this country there are numberless places where trains can be built up at the point of origin to run intact, except for tonnage breaking, from 300 to 1,800 miles. Another advantage that the speedy movement from origin to destination accomplishes is the getting of the cars off your rails and reducting car hire.

Heavier Business Without Larger Terminal Facilities

It is frequently possible to rearrange a yard without great cost so that the capacity will be increased 50 per cent more. We know of one location where 36 tracks on one ladder were so rearranged that four engines can now switch at one time without interference, while crossovers are so arranged that it can all be thrown together when necessary, as if the business should decrease so that only one or two engines are needed. The superintendent advises that this rearrangement increased the capacity at least 50 per cent.

Switching power sufficiently heavy to handle any train that a road-engine brings in is desirable, if not necessary. These switch engines should be equipped with power reverse, clear vision tanks, and in some cases where heavy pulls are necessary, boosters will increase the capacity. Yet in breaking up and classifying trains on a 0.5 per cent grade an engine should not start with more than 20 cars in a cut; and if the grade is flat, or slightly ascending, 15 is sufficient to give them the proper kick.

The rearrangement of schedules by spacing both the inbound and outbound movements will increase the ability to handle business without any real increased cost. Of course, there is a limit to what can be done in this direction, because of the time that business is offered for movement, but by cooperation conditions can be helped very much.

Intermediate terminals, especially where they produce considerable business, can increase the capacity of the larger terminal by bunching all of their loads for various destinations or connections instead of throwing them together for classification at the larger terminals.

Repair tracks should be located directly off the leads, to avoid the necessity of moving bad order cars some distance. Another aid in increasing the capacity of a terminal is the location of stand-pipes and coal docks so that the minimum delay is incurred in supplying engines, and so that inspection and oiling can be done while the locomotives are being supplied, or while the crew is being changed or is eating.

Where new tracks are installed, if at all possible, they should be of such length that they can hold a train without doubling over, as this is a source of great delay and decreases the capacity of the yard. Classifying trains with the main tracker idea in view is of benefit.

The installation of teletype machines so that full consists and diversion information can be worked up, and carding made before the train arrives, helps prevent congestion. Where the expense of these machines is not warranted, the same full information should be received by telegraph.

Power-operated switches are a great help. Increasing the grade of the lead materially increases the speed of switching, which, of course, increases the capacity of the yard.

The proper location of the ice house, where any considerable amount of perishable goods is to be handled, increases the capacity of the yard. Flood lights will increase the speed of night switching. Too often the man who is actually going to use tracks or equipment is not consulted; he can help increase the capacity if taken into conference.

If the congestion is temporary relief can often be had by arranging with intermediate terminals to change this method of making up trains. We know of one place where trains are taken "as is" from connections and run about 100 miles to the next terminal division where ground is cheap and tracks can almost be thrown down without much expense, and in this way increase the handling capacity where the congestion is severe.

Proper records to enable the supervising officer to know that industries are worked at a time which will interfere least with the other terminal work help to increase the total capacity. Working with patrons to get cars loaded to their maximum, or as heavily as possible, is one of the least expensive ways of increasing the capacity of facilities.

Too often crews take advantage of Safety regulations to slow up their work. With the proper co-operation of yardmasters we feel that this tendency can be overcome without conflict with good safety practices.

Some lines are weighing nearly every car these days and where this is prevalent the improper location, or lack of sufficient scales slows the work very much.

There is considerable argument as to whether yard air lines are desirable and some terminals are even abandoning their air lines, but we believe that, properly located they enable trains to be prepared ready to move more quickly. Where there is any turning of cars or trains to be done, if the ground is available, balloon tracks or "Ys" properly located save time.

In some territories industries have about quit cleaning dunnage and refuse from cars. This is an expensive practice for the carriers and should not be permitted. A campaign should be carried on with all the lines in a terminal to see that consignees live up to their obligation of unloading everything from a car, including refuse, so that they can themselves load it out, or so prepare it that it can be set direct to another industry. The Interstate Commerce Commission recognizes this as a consignee's obligations when it permits tariff authority for a charge for failure of consignees to clean cars loaded with certain commodities. We know of some places where this has been worked out very satisfactorily through the regional advisory boards, with one of the weighing and inspection bureaus handling the matter direct with the patron when he does not clean his cars.

There are some places where diversion orders are still accepted at all hours of the day and night, without any understanding that no attempt will be made to move a car if the diversion order is received after a specified hour. There should be an agreement between all lines for possibly two up-set hours after which, when diversions are received, cars will not be moved until the next period. We have seen, at places where no cut-off time is in force, four or five engines following each other from a perishable yard to another yard.

Discussion

That portion of the report dealing with the joint operation of terminals aroused no discussion. However, the committee's comments on the speed of freight trains and especially the hypothetical comparison which it presented between train loads at 30 and 50 miles an hour were severely attacked. R. A. Black, engineer of transportation, C. N. R., Montreal, Que., pointed out in a discussion submitted by letter that increased speed is invariably secured at the sacrifice of tonnage and at a higher cost per gross ton mile. He challenged the accuracy of the committee's assumption as to relative car loadings in its report, stating that it was at variance with the data developed by innumerable dynamometer tests on many railways. He presented extended data to show the inaccuracy of the committee's comparisons and prove that more tonnage will be hauled at moderate speed than at high speed. He stated that fuel consumption, the largest item of transportation expense, will be greatly reduced at more moderate speeds and concluded with the statement that the most economical speed is between 15 and 20 miles per hour.

C. L. Harris, division superintendent C. N. R., Virginia, Minn., also criticized the committee for its emphasis on high speeds for freight trains, calling attention to the increased hazard resulting from such speed and urged the convention to go on record as opposing any such rates of speed as suggested by the committee. Mr. Peck replied to this criticism with the statement that it is necessary to build equipment to meet modern service requirements and if the equipment now used cannot be operated safely at the speeds demanded, car builders must design it to meet new conditions.

When discussing the third assignment of the committee, numerous members asked regarding the proper location of the track scale on the hump. J. M. Niland, district supervisor terminals, B. & O., stated that it has been the experience of his road that when scales were located any considerable distance below the summit the cars move across them too fast for accurate weighing and that at Willard, Ohio, it was necessary to move the scale up the hump. Their scales are equipped with a timing device that prevents a scale from registering until a car has been on it at least three seconds.

Charles J. Birch, superintendent, D. M. & N., Proctor, Minn., stated that it is the practice of his road to weigh all cars in motion coupled at the rate of three cars per minute (25-ft. cars), weights being checked at intervals with still weights to insure accuracy. C. L. Harris, division superintendent, C. N. R., Virginia, Minn., reported a test which he made several years ago in Kansas whereby 2,000 cars were weighed coupled at both ends, coupled at one end and uncoupled at both ends, with no appreciable difference in results, from which he insisted that there was no necessity for uncoupling cars to weigh them, if they are being pushed. He advocated placing the receiving end of the scale 30 to 40 ft. below the top of the hump.

A. P. Stevens, district manager, Car Service Division, American Railway Association, Detroit, Mich., criticized that portion of the committee's report which placed the blame on the shipper for leaving dunnage in cars, stating that many cars unloaded by railway employees are equally open to criticism. F. L. Sample, assistant superintendent, G. T. W., Detroit, Mich., reported increasing trouble in enlisting the co-operation of consignees in cleaning cars as competition between the railways is becoming more keen. P. L. Peffer, trainmaster, N. Y. C. & St. L., Buffalo, N. Y., stated that his road has met this situation by establishing a cleaning yard at Buffalo through which all cars received in interchange are run for cleaning.

F. J. Thompson, superintendent, B. R. & P., New Castle, Pa., emphasized the necessity of the railways checking car cleaning more carefully to insure that cars are satisfactory for loading high class commodities. "We cannot depend on the consignee to do this," he said. J. M. MacArthur, superintendent, C. P. R., Medicine Hat, Alta., stated that it is the practice on his division to scrub cars with hot water before setting them for flour loading, while J. M. Walsh, division superintendent, I. C., Memphis, Tenn., makes it a point to see that all oil spots in the floor or sides of cars are covered with paper before they are set for sugar loading, to avoid contaminating the sugar.

Great Northern-Western Pacific Line Approved

I. C. C. issues certificates for $14,000,000 competitive route into California

WASHINGTON, D. C.

BY a unanimous decision made public on June 20 the Interstate Commerce Commission authorized the Great Northern and Western Pacific to build 200 miles of connecting extensions in Oregon and California, paralleling more or less closely the line of the Southern Pacific, which will give the Great Northern access to San Francisco Bay territory and open many additional routes. The authorization was granted over the opposition of the Southern Pacific and Union Pacific which had led to one of the most hotly-contested cases in the history of the commission.

Certificates were issued authorizing the Great Northern to build from Klamath Falls, Ore., south to Bieber, Calif., 88 miles, and the Western Pacific to build north from Keddie, Calif., to Bieber, 112 miles, on condition that the Great Northern allow the Western Pacific to operate its trains from Bieber to Lookout, Calif., 10 miles. The two companies were also authorized to construct or acquire jointly a line from Lookout to Hambone, Calif., 36 miles, and they have an option to purchase a logging spur of the McCloud River, which extends from Hambone to White Horse and is being extended to a point near Lookout, at an estimated cost of $492,613, subject to a trackage right reserved to the McCloud River Lumber Company.

The cost of constructing and equipping the line from Keddie to Klamath Falls is estimated at $13,636,796, of which $10,066,176 is the Western Pacific portion and $3,570,620 that of the Great Northern. The latter also proposes to expend $800,000 for the rehabilitation of its line from Bend to Chemult, Ore.

The proposed lines will form a new route, via the connection between the Western Pacific and the Atchison, Topeka & Santa Fe at Stockton, Calif., between California, Oregon and points beyond, independent of and competitive with the lines of the Southern Pacific system. The two companies propose to establish a fast freight service making fourth morning delivery from San Francisco to Spokane, Portland and Seattle, with the same service southbound.

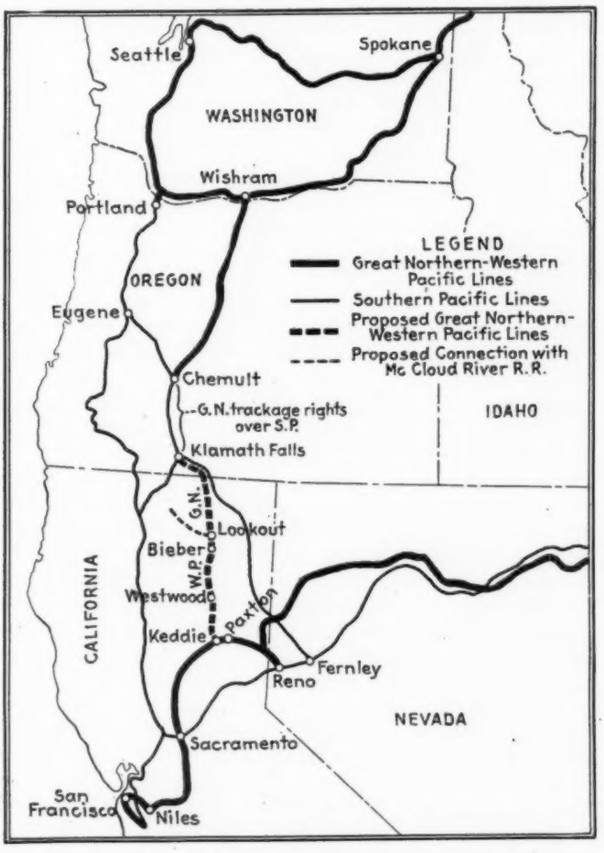
The general manager of the Western Fruit Express Company, a subsidiary of the Great Northern, testified that in case the new line is built the Western Fruit Express Company will obligate itself to supply to the California lines, in addition to the supply available from present sources, a sufficient number of refrigerator cars to handle all shipments which would move from California over the new line.

Through passenger service will be provided by the Great Northern "Empire Builder" train, operating between Chicago, St. Paul, Spokane, and San Francisco. At Spokane the train will divide into two identical sections, one continuing to Seattle and Tacoma, as at present, the other running to San Francisco via Klamath Falls and Bieber. The equipment will include the latest and most improved type of Pullman sleepers, observation cars, diners, and coaches. For passenger service the Great Northern is prepared to open the Spokane gateway to all transcontinental lines, including Canadian lines. Thus, it is claimed, practically all cities and towns on transcontinental lines in North Dakota, Montana, and Idaho would have a service to San Francisco faster and more convenient than at present.

Through north and south passenger service will also be provided via the proposed line between Vancouver, B. C., Seattle, Tacoma, Portland, and San Francisco. Local passenger service will be furnished by gas-electric cars operating between Klamath Falls and Keddie.

Traffic and Revenues

Both sides pointed to the remarkable growth of the Pacific Coast region, the one to show the need of the new rail route between California and the Northwest, the other to show that development has not been hampered by lack of transportation facilities. In the opinion of the chief engineer of the Railroad Commis-



How the Great Northern Will Enter San Francisco

sion of the State of California, there is no reason to believe that the remainder of the traffic on the Shasta route will not continue to increase at the same rate as this traffic has increased in the past, in which event the practicable capacity of this route may be expected to be reached about 1936 or 1937, notwithstanding the diversion of traffic by the Alturas cutoff. Looking a few years ahead, then, the report said, there is presented the alternative of providing a complete second route between the Klamath river and California by the construction of approximately 200 miles of railroad at a cost of a little more than thirteen million dollars as compared to the construction by the Southern Pacific of a second track from Gerber to Eugene, which would cost in the neighborhood of forty million dollars.

He did not think, however, that the entire distance mentioned would have to be double-tracked at that particular time. An official of the Southern Pacific, making allowance for diversions via Alturas, believed the line could handle twice as many trains as at present. In his opinion it would not require double-tracking between Gerber and Black Butte for 12 or 15 years.

The applicants expect to handle 50,523 carloads of freight during the first year of operation and 75,258 the fifth, which with less-than-carload freight will produce revenues amounting to $9,599,858 and $14,328,777 in the first and fifth years, respectively, practically one-half to each applicant. Of total freight revenues approximately 73 per cent the first year and 68 per cent the fifth would come from bridge traffic, hence the major importance of the line as a connecting link between systems.

Diversion of Traffic

Estimates of the amount of traffic which would be diverted and the loss of revenues to existing lines vary within wide limits. A witness for the protestants, computing the applicants' total freight revenues for the first year at $6,054,250, estimated the loss to the protestants at $6,508,978, or 107.5 per cent of the applicants' revenues on the same business. In arriving at these figures, all revenue to the Great Northern north of Chemult is eliminated, most of the new business is excluded, and 98 per cent of the remaining traffic and 100 per cent of its revenue is held to represent business diverted from the Southern Pacific and the Union Pacific system.

In addition, it was claimed, on business diverted from its lines the Southern Pacific would lose more than the applicants gain, approximately $477,000 being added for north and south traffic diverted to the Santa Fe in the region to the south, making a total loss to the Southern Pacific on freight traffic of $5,722,706, equivalent to 94.5 per cent, which with 13 per cent from the Union Pacific, would amount to $6,508,978 or 107.5 per cent of applicants' freight revenues. A witness for the Southern Pacific estimated its loss on passenger traffic at $662,500, which is 76 per cent of the applicants' estimate of passenger revenues. Adding $12,000 for express with a slight addition to freight losses, the witness estimated total loss of revenue to the Southern Pacific the first year at $6,431,000, with a decrease in net railway operating income of $3,020,000.

A witness for the applicants, taking into consideration the probable points of origin and destination and the routes on which the traffic now moves in whole or in part, estimated the loss of the Southern Pacific in freight revenues at $3,940,142 the first year. This added to the protestants' estimate of the Union Pacific loss, would make a total of $4,726,414, equivalent to 49 per cent of the applicants' estimate of freight revenues, without taking into consideration any loss to the Southern Pacific from diversions to the Santa Fe.

Other estimates were submitted, varying in amount and percentage. "On the whole it seems reasonable to assume," the report said, "that the greater part of the revenues which the applicants would secure as a result of the proposed construction would be accompanied by corresponding losses to the protestants. Both sides point to substantial investments in this region and urge their need of additional earnings. It is evident that of the five systems here concerned the need of the Western Pacific is the greatest.

"The railway development in this region has resulted in some loss to the Western Pacific from diversion of traffic; about $200,000 a year from the abandonment of the Northern-California-Oregon line between Wendel and Hackstaff, Calif. For several years past its revenues on Southern Pacific business handled over its line in accordance with contract as a bridge carrier from Chico, Calif., to Weso, Nev., has averaged $776,475 per year, business which since the completion of the Alturas cutoff will be lost to the Western Pacific." Extracts from the report follow:

Rates

Heretofore, with few exceptions, the Southern Pacific has declined to make joint rates with the Western Pacific on long or short hauls in either direction from California points to Oregon, Washington, and the Pacific Northwest. Consequently a Western Pacific shipper must pay an additional charge for switching or local freight rates. Similarly as to Los Angeles; but to this point the Western Pacific has joint rates with the Santa Fe. Interchanging at Stockton, joint rates apply on certain traffic from Santa Fe points via the Southern Pacific to Portland and beyond. It appears that on livestock and grain there are joint through rates from Oregon and Idaho to Arizona via the Union Pacific to southern California, thence via the Santa Fe and the Southern Pacific into Arizona; thus, in so far as they apply, making this a competitive route. Probably due in large part to coastwise steamship competition, rates between San Francisco and Portland are on an extremely low basis.

As to transcontinental traffic, the Southern Pacific has a fairly comprehensive line of joint rates with the Western Pacific. The Southern Pacific, interchanges with the Great Northern at Portland and Chemult gateways, the latter excluding traffic to Portland and Puget Sound points. Rates from California through these gateways apply on practically all commodities to and from Montana and points to the west. Those to Great Northern points east of Minot, N. Dak., excepting citrus fruit, soap, and infusonal earth, eastbound, and grain, flour, dairy products, and a few other articles, westbound, apply from northern California only. Rates through these gateways via the Great Northern to points beyond its eastern terminals apply from northern California, but cover a very limited list of commodities, including fruits, vegetables, and edible nuts.

Pursuant to agreement the proposed route will provide joint freight rates between points on the applicants' lines and points on the Santa Fe and its connections, El Paso, Tex., and Albuquerque, N. Mex., and west thereof. They will also extend to Utah, Colorado, and Eastern and Southern States. The Great Northern would be willing to establish joint rates with other northern lines, thus making the new line a connecting link for all traffic between the northern and southern groups of transcontinental lines.

Applicants propose to remove the "Shasta arbitrary" on round trip fares via the northern route between the East and the Pacific coast. This represents the Southern Pacific revenue for haul between California points and Portland on transcontinental tickets, amounting to $24.33 on a one-way fare. The Southern Pacific estimates the loss to certain western carriers from its removal at $1,100,000 a year, but is willing to remove it entirely on all traffic without the proposed construction, if the northern lines concur.

Financing

The Great Northern expects to finance construction from current funds; the Western Pacific by the issue of 5 per cent

debenture bonds or notes in amount not exceeding $5,000,000, the remainder to be financed from cash assets as available and by the issue and sale of its 5 per cent first-mortgage bonds; any necessary equipment to be financed from treasury funds to the extent available and, if necessary, by equipment trust certificates and/or first-mortgage bonds.

Competition

Most favorably situated on the Pacific coast, the Southern Pacific reaches from San Diego to Portland, while the Union Pacific serves Los Angeles, Portland, and Seattle, and reaches practically all California ports in connection with the Southern Pacific. Thus, it is claimed, these lines have a distinct advantage over the northern lines, having access to the coast both north and south, while the northern lines are confined to the north coast. Moreover, under agreement and by our order, the Southern Pacific is obliged to solicit routing of the maximum amount of traffic from southern Oregon and most of California via Ogden and the Union Pacific and is not in position to give equal treatment to other connecting lines.

The proposed construction would create routes competitive with the Southern Pacific lines in general, more directly affecting the lines north of and including its main line from San Francisco to Ogden, and to some extent would similarly affect the Union Pacific lines north, northwest, and southwest of Utah junctions, and its main line to the east.

San Francisco and Portland are now connected directly by the rails of but a single carrier. The California Railroad Commission points out that this dependence upon the ability of a single rail carrier is without parallel as between comparable agricultural and industrial centers anywhere in the United States. It appears that two-thirds of the population of California, Oregon, and Washington reside in counties bordering on the Pacific Ocean and adjacent waters and that two-thirds of the population west of the Rocky Mountains is within 150 miles by rail from some Pacific coast port.

From San Francisco to Portland there are four steamship lines publishing through rates and maintaining regular service; to Seattle seven; these with all-rail and rail-and-water combinations making 10 routes to Seattle and 36 to Spokane, over all of which routes rates apply. From Los Angeles to Portland there are four steamship routes, the Southern Pacific, and the joint Santa Fe-Southern Pacific; Los Angeles to Seattle, seven steamship and three rail routes, including the Union Pacific via Salt Lake City. From Los Angeles to Spokane, including various combinations, 39 routes are indicated. The applicants claim that regardless of the amount of traffic which now moves by water the new line will handle a large volume of traffic which is dependent solely upon rail transportation.

Generally speaking, the only part of California which now has the benefit of rail competition to or from points in Oregon and Washington is a small area around Los Angeles served by the Union Pacific. With the construction of the proposed line this area would be extended to include all points in California served by the Santa Fe and the Western Pacific.

The protestants exhibit charts showing many joint freight routes by which rates apply from California to transcontinental territory. Access to California is afforded by the Southern Pacific, Union Pacific, Santa Fe, Western Pacific, and coastwise steamers; the multiplication of routes shown being due to interchange within the State and connections at various outside points. Thus between San Francisco and St. Paul, Minn., the protestants claim there are 44 competitive routes over which rates apply. These include routes over the northern lines via the Southern Pacific and the northern gateways. The charts do not show what rates apply. We have already noted the limited number of rates which apply via the Great Northern to St. Paul. Exhibits introduced by the applicants show that many rates via the Missouri River gateways do not apply via Portland or Chemult, and that where they do they are not always the same.

Representatives of the railroad or public utility commissions of Oregon, Washington, Montana, Idaho, Colorado, Arizona, and New Mexico, and a representative of Utah shipping interests stress the value of competitive routes which the new line would afford. The protestants point to many competitive routes via which rates apply to various points in these States.

A number of witnesses testified as to the benefits of competition; as to the increase in population and development of Seattle following the coming of the Great Northern; improvement in service on arrival of the Milwaukee and Union Pacific; improvement in service following the construction of the Western Pacific across Nevada to Salt Lake and the arrival of the Sacramento Northern and Western Pacific at Oroville and Marysville, Calif.; better service between Sacramento and Fresno, Calif.; better stock cars in California and Nevada; improvement in car supply at Eugene, Ore., and Evona, Utah; improvement in passenger service due to competition of motor busses; rate adjustments, better hours for loading fruit, and at Klamath Falls to date, rate adjustments, better service, and more lumber mills.

Other witnesses testified that in its exclusive territory, the Southern Pacific affords excellent service to California walnut growers and to shippers of fruits and vegetables in Salinas and Pajaro valleys. The remarkable growth of the Imperial Valley which is served only by the Southern Pacific is also cited.

Offers of Southern Pacific and Union Pacific

Conditioned on the denial of these applications, the Southern Pacific offers to establish joint through rates between Southern Pacific points in Oregon and northern California, including McCloud, on the one hand, and Ogden and points east, on the other, via Flanigan and the Western Pacific; joint rates between points on the Western Pacific and points on the Southern Pacific in Oregon and beyond (including the Great Northern north of Chemult) on an equality with rates between common or opposite points on the Southern Pacific and such northern points; rates on forest products between McCloud and points on the Southern Pacific in northern California, including Westwood, on the one hand, and points on the Western Pacific in California, on the other hand, which at points south and west of Stockton shall be on an equality with rates to common or opposite points on the Southern Pacific; rates between points on the Southern Pacific and connections south and east of Klamath Falls and points on the Great Northern and connections east of the Cascades beyond Chemult no higher than rates via Portland in connection with other carriers; between points on the Southern Pacific and connections south of Portland and/or east of Klamath Falls and points on the Great Northern and connections west of the Cascades.

The Southern Pacific would join the Great Northern and its connections in the publication of transcontinental rates between points south of Portland and/or Chemult to and including Colfax and Banning, Calif. (including points on the McCloud River Railroad), on the one hand, and eastern transcontinental destinations on the other, via Chemult and/or Portland, on an equality with rates via Ogden, Utah, including diversion and reconsignment.

The Southern Pacific would also join the Great Northern in the publication via Portland or Chemult or both of rates between points north of Chemult or Portland on the Great Northern and connections in the Pacific Northwest and eastern transcontinental destinations via Flanigan, Ogden, Salt Lake City, and El Paso on an equality with rates via the Great Northern through Billings or Minnesota Transfer; the provisions of this and the last paragraph being reciprocal. The above offers would apply to other northern lines as well as to the Great Northern.

Similarly, on denial of the applications, the Union Pacific offers to establish through rates via Butte, Mont., between points in both central and southern California, on the one hand, and points reached by the Great Northern and other northern lines in the northern tier of States as far east as St. Paul and Duluth, on the other hand, making the Western Pacific available for competitive routing in connection with the Santa Fe.

Regardless of the disposition of this case, the Southern Pacific offers to establish an interchange at Flanigan and publish through rates between points exclusively served by the Western Pacific and points on the Southern Pacific and connections north and east of Flanigan. In these offers the Southern Pacific waives its right to the long haul.

The protestants claim that if the through routes are in the public interest, they can be afforded by the Southern Pacific and the Union Pacific as connections with or between the respective lines of the applicants under through joint rates through open gateways as outlined above, thus, in a measure, protecting their earning capacity and at the same time offering all the advantages in routes, service, rates, and diversion privileges that have been proposed by applicants, but with shorter and superior routes, and serving a greater number of people.

The position of the applicants may be summarized as follows: The public benefits which are assured by the proposed construction can not be obtained through the substitute proposals of the Southern Pacific and Union Pacific. The interests of these opposing carriers will always be adverse to the free use of the northern gateways. The preponderance of the Southern Pacific position in California is so overwhelming and its interest in its own long haul will always exert such a dominant influence, that no appreciable volume of traffic could

ever escape to rival rails through interchange at intermediate points. This has been demonstrated by the Western Pacific's experience in California and the Great Northern's experience at Chemult, Ore. Moreover, the program which they offer as the price for the denial of these applications ignores the needs of the local territory.

Military Value

The proposed line would give that much more transportation and furnish an alternate route should an existing line be broken. Its distance from the coast would be an additional protection against coast or air raids. A witness stated that in a time of national emergency existing lines between California and Oregon would be inadequate unless the country had received ample warning.

Conclusions

The principal importance of the proposed line is as a bridge or connecting link between systems. This is true whether judged from the standpoint of prospective earnings or diversions of traffic from other lines. Were the gap to be bridged but 1 mile wide and the cost of construction negligible, the advantages of the connection would be controlling. A two-line haul is better than a three-line haul, and a direct connection, without the interposition of a third carrier, would be clearly in the interest of the public and the transportation system as a whole.

There remains to be considered the question of whether the disadvantages resulting from the length of the line, its cost, or other features, are sufficient to outweigh the advantages of a direct connection between the two systems.

The new line will aid in the development of a great timber area and some considerable agricultural areas in northern California. As we said in *Construction of Lines in Eastern Oregon*, 111 I. C. C. 3, 37:

> Advantages to the shippers of an additional outlet for their product are apparent. It is desirable that transportation facilities of a high order be available to shippers from the Klamath Basin and central Oregon. The assurance of access to lines other than the Southern Pacific at critical periods is a factor of prime importance to such shippers and is clearly in the public interest. Competition within reason, rather than monopoly, is in the public interest.

The new line would give the Klamath Falls shippers the advantage of competition to the south which they do not now enjoy, and to Westwood competition both north and south. It would greatly shorten the distance by rail from Westwood to nearby points in the Sacramento Valley, and that by a line which would be down grade or level all the way. The only material diversion of traffic from the Southern Pacific at points on the new main line between Klamath Falls and Keddie would be lumber at Westwood, estimated at some 4,000 carloads the first year. This represents about 10 per cent of the Southern Pacific's estimated loss in freight revenues from all diversions due to the construction of the line and its use in the handling of bridge and other traffic.

The local traffic would probably be insufficient to justify a line built to the standards here proposed; but considering all traffic available, the applicants have reasonable prospects of earning a fair return on their investments. Compared with the benefits which will accrue to the people of the Pacific West and Northwest through the establishment of new competitive routes, stimulating the interchange of products, the advantage of a diversified car supply, additional passenger service, and the development of the local territory, the moderate capital expenditure here proposed seems amply justified.

The diversion of traffic from other lines will be principally due to the establishment of a direct connection between the systems of the applicants, and must be regarded as incidental to and a necessary consequence of the removal of the bar to the unobstructed flow of traffic between them. These losses may be overcome in a few years by the rapid growth of the country and will not be sufficient to impair the ability of the protestants to perform their duty to the public.

The acquisition of the logging railroad between Lookout and Hambone is justified on similar grounds. Jointly operated as a branch by the applicants, it will extend to the McCloud River Railroad and its shippers the benefits of a direct connection with the lines of the applicants, eliminating the Southern Pacific as an intermediate carrier. The benefits of competitive service in all directions which will be brought to Klamath Falls and Westwood will thus be extended to the industry at McCloud and other shippers on the McCloud River Railroad.

The Indian Valley, a 22-mile line connecting with the Western Pacific, contended that the commission could properly permit the proposed construction only on the basis of its purchase by the Western Pacific, its owners being willing to sell at the fair commercial value before the new construction. The commission called attention to the fact that this line is allotted in its consolidation plan to System No. 18—Missouri Pacific, which includes the Western Pacific, and that it thought it unnecessary in this proceeding to determine the terms and conditions on which the line should be acquired.

Development Association Holds Meeting at Duluth

THE American Railway Development Association, at its twenty-second annual meeting at Duluth, Minn., on June 18, 19 and 20, elected Russell G. East, agricultural agent on the Pennsylvania at Shelbyville, Ind., as president for the ensuing year. Gayle W. Arnold, industrial agent of the Baltimore & Ohio at Cincinnati, Ohio, was elected first vice-president, while J. I. McGregor, general agricultural agent of the Southern Pacific at Houston, Tex., was selected as second vice-president. A. W. Large, general agricultural agent of the Chicago, Rock Island & Pacific at Chicago, was re-elected secretary-treasurer.

H. M. Means, horticultural agent of the Chicago, Rock Island & Pacific, in an address entitled "Freight Claim Reduction at the Source," urged that the agricultural department of the American Railway Development Association and the Freight Claims division of the American Railway Association co-ordinate their educational activities to prevent the shipment of types of fresh fruits and vegetables which will deteriorate rapidly in transit. During 1929 the Western Weighing and Inspection Bureau found that 17.7 per cent of the cars of fruits and vegetables inspected at 11 destination points in the West were damaged. Of that 17.7 per cent, 42.1 per cent of the damage was due to decay, over-ripeness and field and orchard diseases. Of the 49.2 per cent of the cars found to be damaged by the Moorhead Inspection Bureau, 33.9 per cent of the damage was attributed to the same causes, over which the carriers have no direct control.

Mr. Means stated that the growers should be induced to plant standard varieties of fruits and vegetables, to give the proper fertilization and cultivation, to pick and pack without bruising, to use standard containers and to load cars with the proper bracing. Many varieties of fruits and berries that are grown for shipment to distant markets must be picked while in a partially green state. The degree of ripeness depends on the distance to the market, and the time necessary to place the fruit in the hands of the consumer. Overripe fruit will break down and spoil in transit.

As an example of the manner in which a commodity may be developed for maximum hardiness to shipping, as well as proper marketability, Mr. Means turned his attention to the watermelon. Certain varieties of watermelon have been developed that are of exceptionally fine quality. They are crisp and of a fine flavor, but the rind is thin and tender, splitting and bruising at the least exertion of pressure, and they were never intended for shipment. Such melons should be marketed for local consumption. Watermelon varieties suitable for transportation can be kept up to a high standard by the grower himself, through the selection of seed.

Mr. Means said that the principal causes of decay of fruits and vegetables at the point of origin have been

found to be improper crop rotation, planting disease-infected seeds and plants, improper spraying to prevent diseases, using disease-infected containers, over-ripeness, storing in disease-infected places, frost damage in the field, bruising in handling, picking and packing, improper ventilation of storage houses and exposure to heat and sunshine. He advocated the selection of a committee by the A. R. D. A. to formulate a plan of co-operation with allied agencies on the subject of loss and damage claims, suggesting the foregoing causes as proper fields of educational effort on the part of the association.

The Geologist

The place of the geologist in railway development was discussed by Dr. Henry Mace Payne, geologist of the Gulf, Mobile & Northern and consulting engineer for the American Mining Congress. Dr. Payne said in part:

"Our undeveloped resources are our industrial currency for the future. In their development the geologist plays a significant part, and his relation to our national prosperity is that of the banker, since, having located and defined these resources, their production through the application of labor having created wealth, he is the custodian of the nation's working capital.

"It is his business to ascertain the facts and to martial them in such intelligible form as will yield most readily to industry, not only the technical but the practical information upon which investment and development are predicated. Not until this groundwork has been laid does the engineer or the investor begin to function. No matter how rich a country may be in mineral resources, it must remain a purely agricultural country, and no purely agricultural country is a prosperous and industrial country without the diversified production of mine and mill and farm and factory.

"It is true that in many cases the mineral development of one state may furnish a greater prosperity to an adjoining state through natural trend of commerce, but we have learned that when one suffers, all suffer; and when one prospers, all prosper. No country and no state ever became rich through the production of raw material alone.

"An efficient program for railroad development should be based on accumulated facts ascertained by the geologist, made available in such form as will invite the attention of investors and seekers for raw materials, and widely spread through current advertising, and through distribution to the railroad's stockholders and directors, thus not only making most widely known where such materials may be obtained, but also as showing the valuable assets back of the railroad investment. A competent geologist, experienced in the economic production of minerals and familiar with their marketing, who combines with his work as a 'rock hound' a lively sense of industrial economics and who keeps abreast of the times, who notes the trend towards decentralization and diversification, and who senses the value of a local payroll in the small towns along his road, is as essential to the development department of a railroad, as is the carburetor to the automobile. Moreover, through co-operation with the engineering and traffic departments, the geologist may be of great interdepartmental value, and may serve in matters of public relations between the executive heads and the public generally."

Conserving Industrial Property

Arthur E. Gilman, manager of industrial development of the Missouri-Kansas-Texas Lines, in discussing "The Conservation of Land Adjacent to the Railroad Right of Way," stated that the effectiveness of the methods and practices commonly used by various railroad development departments is determined largely by the alertness of the department staff members, their means of keeping informed concerning industrial property available to their railroad, the character and extent of their contact with industrial realtors, land owners, financial interests, business associations and city officials. His address was based upon replies received from representatives of a number of railroads in response to an inquiry which he made.

Mark Fenton, general industrial agent of the Illinois Central, in his reply stressed the need of investigating tonnage and revenue to be derived by the railroad in the leasing of ground. Industrial property should not be disposed of to other than tonnage-producing concerns, he said. C. C. Rockenback, industrial commissioner of the St. Louis Southwestern, mentioned the necessity of insuring that all property adjacent to a railroad that should be included in zoning ordinances as industrial property is so designated. J. B. Hilton, industrial commissioner of the St. Louis-San Francisco, felt that the railroads have been negligent in the conservation for their own properties. He had noted many railroads which set aside very valuable potential industrial property for the location of section houses and their accompanying buildings.

A number of industrial commissioners looked upon city zoning ordinances as the most effective means of combatting the diversion of industrial property into other channels. This method safeguards a railroad against the creation of residence sub-divisions along parts of its right of way which should be ultimately devoted to industrial uses. L. E. Clarahan, general industrial agent of the Wabash, in his reply referred to the tendency in larger cities toward the creation of carefully planned industrial districts of considerable size.

Other speakers included J. H. Dolvin, industrial agent of the Atlanta, Birmingham & Coast, who presented a plan for the readjustment of the original cost to an industry of an industry-owned lead track, J. H. Hearding, assistant general manager of the Oliver Iron Mining Company, who described the development of the iron ore industry in the Lake Superior district, and a discussion of the co-ordination of railway development programs with those of state extension services, which was led by Nat T. Frame, director of extension of the University of West Virginia, P. F. Schowengerdt, director of agricultural development of the Wabash, J. W. Haw, agricultural development agent of the Northern Pacific, and J. F. Jackson, general agricultural agent of the Central of Georgia.

On June 20 and 21 those present at the meeting participated in a tour of the iron ore district in the vicinity of Virginia, Minn., and Hibbing. The 1931 annual meeting of the development association will be held at Philadelphia, Pa., in May or June on a date which will make possible the holding of a number of joint sessions with the Railway Magazine Editors Association.

FIVE RAILROADS IN KANSAS, the Atchison, Topeka & Santa Fe, the Chicago, Rock Island & Pacific, the Missouri-Kansas-Texas, the Missouri Pacific and the St. Louis-San Francisco, will appear before the state public service commission at Topeka on July 22 to answer a complaint filed by the Brotherhood of Railroad Trainmen, which alleges that the roads are operating trains without full crews and an insufficient number of flagmen.

Suit Against E. J. & E. Under Commodities Clause

WASHINGTON, D. C.

APPARENTLY in an effort to find out if the courts will allow the commodities clause of the interstate commerce act to be read backward, the Department of Justice, at the instigation of the Interstate Commerce Commission, on June 19 filed suit against the Elgin, Joliet & Eastern in the federal district court for the northern district of Illinois at Chicago for a writ of mandamus directing the railway to cease and desist from transporting commodities, in which any of the companies controlled by the United States Steel Corporation have an interest. The Steel Corporation owns all the stock of the railway company, according to the petition filed by direction of the Attorney General, which also sets forth the relations existing between the Steel Corporation and various subsidiary companies whose products are hauled by the E. J. & E.

The commodities clause, originally intended to prohibit railways from transporting commercial coal in which they are interested, provides that after May 1, 1908, it shall be unlawful for a railroad to transport in interstate and foreign commerce "any article or commodity, other than timber or the manufactured products thereof, manufactured, mined, or produced by it or under its authority, or which it may own in whole or in part, or in which it may have an interest, direct or indirect, except such articles or commodities as may be necessary and intended for its use in the conduct of its business as a common carrier."

The suit is based on the theory that the E. J. & E. has an indirect interest in the commodities produced by the Steel Corporation and its subsidiaries, and is understood to represent a test case, which, if the government should be successful, would be used as a precedent in dozens of cases of railroads owned or largely controlled by manufacturing industries. The Steel Corporation also controls the Duluth, Missabe & Northern and the Bessemer & Lake Erie and other large companies control many railroads of considerable importance, in addition to many short switching lines connecting their plants with the trunk lines.

The Interstate Commerce Commission in many cases has indicated its disapproval of the idea of an industry controlling a railroad, on the ground that it tends to discriminatory practices in favor of the company owning the road, and has often condemned divisional arrangements or allowances made to industrial roads as amounting virtually to rebates.

It is understood that attorneys for the Department of Justice, in collaboration with members of the commission staff, have been studying the situation for two or three years with a view to deciding whether an attempt to prosecute a case of this kind under the commodities clause would be successful, although there has been no very prominent suggestion that the law be amended to provide specifically that an industry shall have no interest in a railroad. It has often been stated that the possibility of such a suit was one of the reasons, if not the controlling reason, for the sale of the Detroit, Toledo & Ironton by the Ford interests to the Pennroad Corporation.

The petition filed against the E. J. & E. avers that approximately 60 per cent of its revenues are derived from products of the Steel Corporation and subsidiaries.

Freight Car Loading

WASHINGTON, D. C.

REVENUE freight car loading in the week ended June 14 amounted to 927,754 cars, or less than were reported in several earlier weeks. This was a reduction of 143,491 cars as compared with the corresponding week of last year and a decrease of 75,059 cars as compared with 1928. Miscellaneous loading showed a reduction of 63,562 cars. All districts reported reductions as compared with both preceding years, except the Southwestern, which showed an increase as compared with the corresponding week of 1928. The summary, as compiled by the Car Service Division of the American Railway Association, follows:

Revenue Freight Car Loading

Week Ended Saturday, June 14, 1930

Districts	1930	1929	1928
Eastern	208,082	248,164	830,923
Allegheny	191,002	224,677	206,587
Pocahontas	33,812	62,235	54,118
Southern	125,073	143,178	142,204
Northwestern	149,137	171,555	162,591
Central Western	128,356	142,133	136,446
Southwestern	72,292	79,303	69,944
Total Western Districts	349,785	392,991	368,981
Total All Roads	927,754	1,071,245	1,002,813
Commodities			
Grain and Grain Products	38,947	42,175	33,989
Live Stock	20,643	23,525	24,774
Coal	136,780	156,231	143,940
Coke	9,382	12,466	9,709
Forest Products	50,070	70,832	66,363
Ore	62,433	74,381	66,609
Merchandise L.C.L.	243,045	261,619	259,237
Miscellaneous	366,454	430,016	398,192
June 14	927,754	1,071,245	1,002,813
June 7	935,647	1,055,768	995,570
May 31	860,249	972,825	934,673
May 24	931,472	1,062,088	1,021,403
May 17	930,004	1,046,594	1,003,288
Cumulative total, 24 weeks	21,351,260	23,452,085	22,470,714

Car Loading in Canada

Revenue car loadings at stations in Canada for the week ended June 14 totaled 64,609 cars, a decrease from the previous week of 1,878 cars and a decrease of 10,888 cars from the same week last year.

	Total Cars Loaded	Total Cars Rec'd from Connections
Total for Canada		
June 14, 1930	64,609	31,514
June 7, 1930	66,487	31,162
May 31, 1930	67,745	33,658
June 15, 1929	75,497	39,791
Cumulative Totals for Canada		
June 14, 1930	1,401,825	861,486
June 15, 1929	1,557,120	1,027,894
June 16, 1928	1,527,210	950,536

* * *

The Stettin Station at Berlin, Germany

Substitute for Couzens Resolution Reported

WASHINGTON, D. C.

AFTER struggling for a week with a substitute for the Couzens railway unification resolution, and after reporting to the House on June 24 a completely rewritten text omitting entirely the provision which would have suspended the authority of the Interstate Commerce Commission but including a prohibition against the acquisition of two or more carriers subject to the interstate commerce act in any manner by anyone without the approval of the commission, the House committee on interstate and foreign commerce on June 25 capitulated to the demands of those who are opposing a unification of the Great Northern and Northern Pacific by adopting an additional provision suspending the commission's authority as to this particular case only. The addition was expected to be offered as a committee amendment on the floor of the House.

In the resolution as reported the committee had also adopted a provision authorizing the commission to require that hardships or losses imposed upon employees as a result of acquisition of control or consolidation of railroads shall be minimized or compensated for, and a provision authorizing the commission to determine what is just and reasonable and in the public interest in regard to losses sustained by reason of change of location of offices or shops in certain cases. The retroactive feature of the Couzens resolution passed by the Senate, which sought to make unlawful the exercise of control over two or more carriers by holding company or otherwise, was entirely eliminated, however, and it was proposed to amend the title to show that it was intended to "define and extend" the authority of the commission, instead of to restrict it.

A complete substitute for the Couzens resolution was drafted by a sub-committee of the committee on interstate and foreign commerce and was approved by the full committee on June 19, but further changes were adopted in the language on the following day and again on June 23 when the committee ordered a favorable report. The substitute measure as reported, however, failed completely to meet the views of the Representatives from the northwestern states who have been trying to gain credit for themselves by stopping the merger of the Northern lines, which many have believed had already been prevented by the commission when it imposed as a condition the requirement that they give up their control of the Burlington. Representatives of the railway labor organizations also kept up their insistence on the provisions of the Couzens resolution and, in the face of the Fall elections, a substantial bloc was created which talked about keeping Congress from adjourning until the Couzens resolution was passed. Senator Couzens had also indicated his opposition but there was a belief that he might accept the substitute rather than nothing because it met his original declared purpose to prevent further unauthorized acquisitions by holding companies. For over a year he has been advocating such legislation, although his resolution was not introduced until the commission's report in the Great Northern Pacific case had stirred the labor organizations to action.

It had been generally understood that the House committee would do nothing with the Couzens resolution at this session, and there had been plans for an adjournment of Congress before this time, but it was subjected to tremendous pressure and some of its members thought something ought to be done to prevent further acquisitions by holding companies pending further consideration of legislation to amend the consolidation provisions of the transportation act after the completion of the committee's investigation of holding companies. In its 1928 report to Congress the commission pointed to the problem created by the acquisition of control of railroads by individuals or groups of individuals, without the prior approval of the commission, at a time when it was working on a plan of consolidation. This undoubtedly referred to the activities of the Van Sweringen interests. Again, in the 1929 report, it called attention to the acquisitions by holding companies affiliated with the Van Sweringen interests and the Pennsylvania and urged Congress to investigate the subject with a view to further legislation. Commissioner Eastman, in testifying before the committee, took the position that the acquisitions by holding companies amounted virtually to consolidation and urged the need of legislation to control the situation, but he did not favor such extreme measures as proposed by the Couzens resolution and the language adopted by the House committee indicates the influence of his views.

As adopted by the House committee on June 19 the resolution provided:

"That (a) in any hearing upon an application to the Interstate Commerce Commission for authority to acquire control of any carrier or carriers by railroad or to consolidate the properties, or any part thereof, of any such carriers, the employees of any carrier by railroad involved in the acquisition or consolidation, or the representatives of any such employees, may intervene and be heard. As a condition of its approval of any such acquisition or consolidation, the commission is authorized to require that hardships or losses imposed upon any employees as a result of such acquisition or consolidation shall be minimized and/or compensated for by the carriers involved, so far as the commission determines that it is just and reasonable and in the public interest to do so.

"(b) The acquisition of control in any manner of two or more carriers by railroad, by or through any holding or investment company, voting trust, or other person not a carrier by railroad, whether such control is held directly, or indirectly through one or more such persons, is hereby prohibited, unless approved by the Interstate Commerce Commission. The provisions of the Interstate Commerce Act, as amended and supplemented, applicable with respect to an acquisition of control by one carrier or another carrier or carriers, shall be applicable with respect to any acquisition of control under this paragraph. Any violation of this paragraph may be enjoined by any court of competent jurisdiction at the suit of the United States, the Interstate Commerce Commission, any commission or regulatory body of any state in which is located any part of the lines of the carrier by railroad, or any party in interest."

As originally drafted the resolution included in paragraph (b) a prohibition of "the exercise of control heretofore or hereafter acquired in any manner" unless "heretofore or hereafter" approved by the commission, but it was decided to omit the retroactive feature.

At a meeting on June 20 the committee added another provision to paragraph (a) proposed by Representative Rayburn, of Texas, that "the commission shall determine what is just and reasonable and in the public interest with regard to any losses sustained by reason of the change of location of offices or shops where such losses arise under a contract for value, a bond issue or any provision of law with respect to the location of general offices or shops of any carrier involved in such acquisition or consolidation."

A proviso was added that the provisions of the resolution should not apply when the only carriers involved are street, suburban and interurban electric railways not operated as parts of a general steam railroad system of transportation.

The added section reads: "The authority of the Interstate Commerce Commission under existing law or this joint resolution to approve and authorize any acquisition of control or consolidation of railway properties of the Great Northern Railway Company and the Northern Pacific Railway Company, or their successors, or to enter any final order with respect to any such acquisition or consolidation heretofore approved or authorized, is suspended until March 4, 1931; and the authority of the carriers or other persons involved therein to carry out any such acquisition or consolidation heretofore approved and authorized by the commission, is suspended until such date." The latter part of the sentence was added out of abundance of caution, apparently to meet the views of those who have contended that the commission has already "authorized" the unification by issuing a finding that it would be in the public interest if its conditions should be complied with.

Fifteen Representatives of eight northwestern states held a meeting after which Representative Knutson, of Minnesota, said it was "the unanimous consent of the meeting that the committee resolution was entirely unsatisfactory and failed to meet the aims of the original resolution." He said that the group that met "speaks for about 100 members of the House" and that he had been informed that other members from several large eastern states would join the movement to block adjournment of this session of Congress until satisfactory legislation is enacted.

Those opposing the Northern unification have also kept up their efforts to influence the Interstate Commerce Commission. They received from Chairman McManamy another letter saying that their letter indicated a possible misunderstanding of the situation and that "We cannot undertake to suspend or postpone this or any other matter before us under the law in anticipation of further legislation by Congress," but calling attention to the fact that the Minnesota Railroad and Warehouse Commission was a party to the proceedings before the commission and that if it wanted a modification of the commission's findings it might file a petition to the commission in the regular way.

Acting on this suggestion the Minnesota commission filed a lengthy petition which was made public June 21 asking for a re-opening of the case for further hearing and argument, declaring that the employees of the roads had not been given an opportunity to show how they would be affected by the proposed unification and that the commission had reached conclusions not warranted on the evidence as to the elimination of competition. The petition took the position that the "proposed merger will completely eliminate all benefits accruing to the public from the present aggressive competition enforced between the two lines of railway herein involved" and that the public had not been sufficiently informed in advance as to the effect.

In its report the House Committee said in part:

The committee finds it inadvisable at this time to enact the joint resolution in the form in which it was passed by the Senate. Some of the policies embodied therein the committee feels do not demand emergency action by the Congress, and legislative action upon such policies should await the completion of the investigation now being conducted by the committee upon railway unifications and holding companies. On the other hand, the committee is of the opinion that there are defects in the existing provisions of the interstate commerce act relating to acquisition of control of carriers and consolidation of their properties that demand immediate consideration by the Congress and that should be remedied by provisions of law permanent, rather than temporary, in character. The committee has therefore reported a substitute for the joint resolution as passed by the Senate, covering three matters of emergency character which, in the judgment of the committee, should be enacted into law at the present session.

These matters are grants of authority to the commission with respect to, first, hardships and losses suffered by railroad employees as a result of unifications of railroads; second, losses suffered as the result of such unifications by states, municipalities, or individuals under contracts for value or provisions of law governing the location of general offices or shops of railroads; and, third, acquisitions of control of two or more railroad carriers by individuals, holding or investment companies, voting trusts, and other noncarrier persons.

Under the railway labor act, Congress has approved the policy of railroad employees being represented by representatives of their own designation, and the substitute, pursuant to this policy, permits the employees also to intervene and be heard through such representatives. The committee understands that the commission is now of the opinion that section 5 of the interstate commerce act, properly interpreted, grants authority to the commission to make proper provision for these matters in connection with its approval of any acquisition of control or consolidation of properties. The section, however, contains no specific provision upon these matters and the committee believes that any doubts as to the existence of the authority should be removed by the enactments of a definite provision of law.

The hardships and losses contemplated by the committee amendment may, of course, be of widely diverse character. They may be illustrated, however, by such hardships and losses as result from reductions and changes in the carrier's force, or as result from changes of residence or from the disposal of homes forced by changes in the location of the railroad shops or offices.

The existing law (sec. 5 of the interstate commerce act) regulates acquisitions of control by one carrier of another carrier or carriers but does not cover acquisitions of control by individuals or by holding or investment companies of carriers. The committee agrees with the commission that this defect should be immediately remedied by legislation in order to preserve competition. . . .

The control covered by the provisions of the substitute is actual control acquired by individuals, associations, or corporations which are not carriers and which therefore do not own and operate railroad properties but nevertheless separately or jointly direct or have the power to direct the railroad carriers' operations and management by virtue of stock ownership in the carriers, voting trust agreements, or other contractual arrangements in respect to the stock or securities of the carriers or the properties operated by them.

Such control is usually held by holding or investment companies, although instances have been brought to the attention of the committee in which individuals have held a controlling interest in the voting stock of a carrier. The control may be held directly or indirectly, and the provisions of the substitute are sufficiently broad to cover control held through one or more intervening corporations or associations. The substitute would not apply to acquisitions where actual control already exists or to acquisitions of less than actual control.

It should also be noted that, while the substitute is prospective in operation and applies only in the case of an acquisition of control of at least two carriers consummated after the passage of the joint resolution, this requirement would be met even if control of one of the carriers had been acquired prior to the passage of the resolution.

The substitute further provides that the provisions of the interstate commerce act and the supplementary acts applicable with respect to acquisitions of control by a carrier shall be applicable with respect to acquisitions of control under the joint resolution by a holding or investment company or other person. The substitute thereby becomes not only a prohibition against unauthorized acquisitions of control but also a grant of authority to the commission to approve acquisition of control. Such approval would be subject, however, to the same limitations of public interest and the like as now govern the approval by the commission of acquisitions of control under section 5 of the interstate commerce act. In addition, the procedural provisions of the interstate commerce act and regulations thereunder would apply, including the various inquisitorial, administrative, and penal provisions.

Moreover, an acquisition of control approved by the commission under the substitute would give to the carrier affected the same relief from the operations of the antitrust laws as now provided by section 5(8) of the interstate commerce act in the case of acquisitions of control under that act. In other

words, the committee has sought to place upon a parity under the law acquisitions of control of two or more carriers irrespective of whether the control is acquired by a carrier, on the one hand, or by an individual, holding or investment company, voting trustee, or other noncarrier, individual, corporation, or association, on the other hand, save that in the latter case unapproved acquisitions of control are, in addition, specifically declared to be prohibited by the substitute.

Proposed Acquisition of W. & L. E.

WASHINGTON, D. C.

THE hearing on the application of the Pittsburgh & West Virginia for an authorization from the Interstate Commerce Commission to acquire control of the Wheeling & Lake Erie was concluded on June 23 and is to be followed on July 8 by a similar hearing on its application for the Western Maryland.

At the close of the hearing C. V. Burnside, assistant director of the Bureau of Finance, announced that the commission had granted the motion of the Wheeling counsel that Frank E. Taplin, president of the P. & W. V., be required to state for the record the price at which he had sold 222,930 shares of his company's stock to the Pennroad Corporation, and had denied the motion of the P. & W. V. to dismiss the intervening petition of the Wheeling company. Mr. Burnside overruled a motion of the P. & W. V. that testimony offered by the Nickel Plate to show that the Wheeling should be allocated to its system be stricken from the record. C. F. Taplin, general counsel for the P. & W. V., had objected to this line of testimony when it was offered, saying that the Nickel Plate was attempting to make the same kind of presentation it would have had its own application for authority to acquire the Wheeling not been withdrawn, but Mr. Burnside said the Wheeling must be allocated to some road and that testimony of that kind would help the commission, besides being pertinent to the Nickel Plate contention that the Wheeling should not be assigned to the P. & W. V.

Presentation of testimony on behalf of the applicant was concluded on June 19, after which the P. & W. V. filed answers to a series of questions which had been propounded by the Pittsburgh Investment Company, which had intervened in the case as the owner of 100 shares of P. & W. V. stock. The answers disclosed that the P. & W. V. had paid $4,326,669 for about 12 per cent of the Wheeling stock at an average of $176.63 for 45.13 shares of the prior lien stock, $82.87 for 14,600 shares of preferred, and $52.34 for 59,400 shares of common, and that no proposal had been made for the purchase of 34 per cent of the Wheeling stock held by F. E. Taplin and associates. A statement was furnished showing the number of shares of P. & W. V. stock held by its directors as of April 30, 1928, 1929 and 1930. F. E. Taplin's holdings were shown to have increased from 2,850 shares in 1929 to 222,930 in 1930, while C. F. Taplin was shown as holding 5 shares. It had been testified that the stock sold to the Pennroad Corporation had been left in Mr. Taplin's name. It was stated that the company had no knowledge as to whether any of the other directors had sold stock to the Pennroad. In reply to questions as to the Connellsville extension of the P. & W. V. it was stated that the line is expected to be completed by the end of the year and that the company has not changed its opinion as to its advisability.

The presentation on behalf of the Nickel Plate was begun on June 20 when J. H. Day, freight traffic manager, began a voluminous statement supplemented by many exhibits to show that the Wheeling would fit better into a system including the Nickel Plate, such as System No. 6—Chesapeake & Ohio, in the commission's plan. Mr. Taplin objected to the character of the testimony. In allowing it to proceed Mr. Burnside expressed the opinion that it might have been better to have deferred the hearing on the P. & W. V. application until it could have been considered jointly with that of the Nickel Plate, but Mr. Taplin said it had already been deferred for over two years, largely as the result of the activities of the Nickel Plate in "putting in applications and pulling them out again."

Mr. Day spent nearly two days in presenting a comprehensive study of the traffic of the roads involved, saying that the Nickel Plate is dependent upon the Wheeling for access to southern Ohio and affords it exceptional routes for through traffic to Chicago and to points east of the Buffalo gateway. He said the relations between the two roads had always been close and that with the Wheeling in the hands of a competitive system the Nickel Plate would be wholly at the mercy of its competitors as to much traffic. One of his exhibits showed that the carload interchange between the two in joint road-haul service in 1928 amounted to 45,671 cars and that more freight is interchanged between the Wheeling and the roads in System No. 6 than with any others.

George W. Burpee, of Coverdale & Colpitts, also testified as to the results of an exhaustive study showing the Wheeling should be included in System No. 6 rather than in the proposed Wabash system, No. 7.

After cross-examination of these witnesses, Mr. Taplin stated that he had been notified that the Pittsburgh Investment Company had withdrawn as an intervener in the case after he had requested the issuance of a subpoena requiring the presence of the president of the company.

THE GREAT WESTERN RAILWAY OF BRAZIL handled the largest number of ton-miles and reported the greatest net operating profit in its entire history during the fiscal year ending December 31, 1929, according to its recent annual report. Improved organization and operating methods and an unusually heavy sugar crop were listed as the main reasons for the favorable showing. Dividends of three per cent were paid on common stock, the first disbursement on these shares in 16 years, while over £72,000 was placed in the sinking fund and £20,000 (about $100,000) in a special reserve for contingencies.

THE BOSTON ELEVATED RAILWAY, which received the Anthony N. Brady Gold Medal for its safety record in the year 1928, has issued in book form a full and detailed account of the measures it took to amplify its records and improve its service with a view to making a showing which should deserve such recognition. This is a handsome cloth-bound book of 190 pages, embellished with numerous instructive illustrations. The minute recognition of details is indicated, for example, by a page giving the autographs of the men who have been 45 years or more in the service of the company. Measures for promoting the health and safety of employees and other social matters are dealt with at length. These lines which, since 1918, have been operated by the state of Massachusetts, through a board of public trustees, consist not only of elevated railroad lines but also a great mileage of surface street railways, and the total number of passengers carried averages about a million a day. Included in the operations of the company are 293 motor coaches.

Looking Backward

Fifty Years Ago

The gage of the Western division of the New York, Lake Erie & Western [now the Erie], from Hornellsville [now Hornell], N. Y., to Dunkirk, 154 miles, was changed from 6 ft. to 4 ft. 8½ in. on the morning of June 2. A force of 800 men completed the work in six hours. On the same day the gage of the New York, Pennsylvania & Ohio [now part of the Erie], was also changed from 6 ft. to 4 ft. 8½ in. between Dayton, Ohio, and Leavittsburg, 224 miles.—*Railroad Gazette,* June 25, 1880.

The West Jersey & Atlantic [now part of the Pennsylvania] was formally opened for business on June 16 when an excursion train passed over the road and a celebration was held at Atlantic City, N. J. The line connects with the West Jersey [also a part of the Pennsylvania] by which it will be operated, at Newfield, N. J., forming a route between Philadelphia and Atlantic City. A large and convenient excursion house has been built at the Atlantic City terminus and will be under the control of the railroad.—*Railroad Gazette,* June 25, 1880.

Twenty-Five Years Ago

J. P. O'Brien, general superintendent of the Oregon Railroad & Navigation Company [now the Oregon-Washington Railroad & Navigation Company], has been appointed general manager of that railroad and the Southern Pacific Lines in Oregon.—*Railway Age,* June 30, 1905.

Following the wreck of the Twentieth Century Limited on the Lake Shore & Michigan Southern at Mentor, Ohio, on June 21 the president of the road gave notice that the schedule between New York and Chicago would be placed on a 20-hr. basis. Later it was determined that the speed of the train had nothing to do with the derailment and on June 26 the schedule of 18 hr. was restored.—*Railway Age,* June 30, 1905.

In a recent interview James J. Hill stated that "Southern planters are burning their cotton. Japan and the Far East could take 2,000,000 bales of our cotton, but the past year they took only 200,000 bales. Not long ago we made a through rate from Galveston to Hongkong and encouraged shipments. The government ordered us to publish our rate—make it known to the world. We declined and discontinued the rate. The cotton is being burned. The laws of trade are as certain as the laws of gravitation, and you might as well try to set a broken arm by statute as to change a commercial law by legislative enactment."—*Railroad Gazette,* June 30, 1905.

Ten Years Ago

The Interstate Commerce Commission on June 19 issued two additional priority orders in favor of bituminous coal shipments, one giving preference to pooled coal for transshipment at tidewater for movement to coastwise points, amounting to an embargo on export coal, and the other giving bituminous coal preference in the use of open top cars east of the Mississippi river for 30 days.—*Railway Age,* June 25, 1920.

Walter J. Towne, engineer maintenance of way of the Chicago & North Western, has been promoted to chief engineer of that road. J. V. Neubert, engineer of track of the New York Central, Lines East of Buffalo, has been promoted to engineer maintenance of way of the same region. Jay V. Hare has been appointed secretary of the Reading Company and the Philadelphia & Reading. John J. Ekin, who was federal auditor of the Baltimore & Ohio, has been appointed comptroller of the same road.—*Railway Age,* June 25, 1920.

New Books

Books and Articles of Special Interest to Railroaders

(Compiled by Elizabeth Cullen, Reference Librarian, Bureau of Railway Economics, Washington, D. C.)

Books and Pamphlets

Bulletin of Information re the Inland Waterways Corporation. Discusses history, organization and services. 9 p. Issued by Inland Waterways Corporation, Washington, D. C. *Apply.*

A Co-operative Course in Railroad Operation, by John B. Babcock, 3d. "This paper is intended to cover three main topics: (1) the reason for giving the course; (2) the basic principles of the M. I. T. Co-operative Plan; and (3) the particular features of the railroad course which may be of interest." The Boston & Maine is the co-operating railroad. 15 p. Pub. in Proceedings of Association of Co-operative Colleges, Vol. 1, 1929. Also printed separately. Available from Author, Cambridge, Mass.

First Aid Service in Small Industrial Plants. Discusses location, equipment, and records necessary for a useful first-aid station, also legal aspects of first-aid. Industrial Health Series No. 1. 20 p. Pub. by Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York City. *Apply.*

Ocean Routes in United States Foreign Trade, by A. Lane Cricher. ". . . . 'ocean trade routes' denotes the movement of commerce between broad geographic areas; i.e., between our four coastal districts and several foreign regions, the latter being decided upon after analysis of the nature of the traffic and the practical problems of transportation." Charts, and graphs. Analyses on tonnage and on value basis. Trade promotion series no. 96. 33 p. Pub. by U. S. Govt. Print. Off., Washington, D. C. 10 cents.

Toward Civilization, edited by Charles A. Beard. "In the pages that follow a group of scientists and engineers inquire into the dynamics of their labors with peculiar reference to the human aspects. It is now a case of the 'insiders looking out.' The authors of 'Whither Mankind' reviewed the past and surveyed their present. The authors of this book are not concerned with history but with prospects, with work in course." p. v. Roy V. Wright discussed "Transportation" p. 98-119. The late Elmer A. Sperry discussed "The Spirit of Invention in an industrial Civilization" p. 47-68. Lillian M. Gilbreth discussed "Work and Leisure" p. 232-252. 307 p. Pub. by Longmans, Green & Co., New York Cty. $3.

Periodical Articles

The Achievements and Possibilities of Air Transport, by F. Handley Page. Achievements to date, aeroplane developments with special reference to noise control and night flying, airship developments, private flying, military aeroplanes, and future relations of air transport with other forms. "If we look forward by the light of these facts, we see a time when trains are used for the transport of goods; when motor cars are used for public and private transport over relatively short distances, and when the aeroplane is used for public and private transport over longer distances. . . . This happy state of affairs awaits the development of suitable aircraft." p. 378. Journal of the Institute of Transport, June 1930, p. 371-379.

Concerning Trains, by James Norman Hall. ". . . . I can no more conceive of a world without railroads, and trains to run on them, than I can imagine wishing to live in such a world . . . Most of man's mechanical creations are mere monsters of speed, or efficiency, or ingenuity, or a combination of all three. The steam locomotive engine alone has a sort of kinship with warm-blooded creatures." p. 154. Harper's Magazine, July 1930, p. 154-158.

Persia's New Outlook in Transportation, by Henry S. Villars. "motor trucks, better roads and railroads are making material changes." Illustrated. Commerce Reports, June 16, 1930, p. 667-669.

Odds and Ends of Railroading

Grand Opera Star

Another railway girl who has made a name for herself as a grand opera singer, is Kathryn Newman, daughter of Engineman W. E. Newman of the Missouri Pacific at Wichita, Kan.

A Concrete Moon

Engineman E. C. Clarke of the Chesapeake & Ohio at Richmond, Va., wins the prize for the most bizarre house decoration. Attached to his chimney is a relief model of the moon, astronomically correct, made of concrete. Meteoric particles, taken from the shooting stars of 1833, represent the craters and mountain ranges on the model.

A Plea for the Simple Life

New transcontinental trains advertise a soda fountain, radio loud speakers all over the place, telephones, barber shops, shower baths, squawking pitchers, and all sorts of things. When we go on vacation this summer we're going to sneak down to the raiload yards at night, crawl into a freight car, and hide under a load of shingles or dressed hides. We are going for a rest.—R. H. L., Chicago Tribune.

Railway Relics Wanted

The Museum of Science and Industry of Chicago, founded by Julius Rosenwald with a $3,000,000 endowment, is seeking for permanent exhibition articles reflecting various aspects of railway transportation. The Museum will occupy the building which formerly housed the fine arts exhibition in the World's Columbian Exposition in Chicago, of 1893, and it is estimated that the collection, when complete, will be valued at at least $30,000,000.

Polecat in Tender

When Pennsylvania engine No. 6971 pulled into the East Altoona enginehouse recently, completing her run from Enola, Pa., the air was filled with fumes and scents that would outclass a first-class glue works. Engineman R. B. Wadsworth and Fireman M. M. Naylor had noted the aroma before, and were ready to enjoy the remarks of the boys in the house. The trouble was soon located in the tender, where, after digging away the coal, a perfectly good polecat was ready for its own funeral. The source of the scent was quickly placed in the firebox and all present breathed more freely.

"Oh, Yeah?" Filmed on U. P.

The Union Pacific System played an important part in the filming of "Oh, Yeah?," a current Pathe picture, in which Robert Armstrong and James Gleason are featured. Much of the action of "Oh, Yeah?" takes place in a railroad construction camp in a rugged section of California. For more than a week, the entire company with players, Director Tay Garnett and a large technical staff, lived in railroad cars in a community unto themselves far from the madding crowd. The Union Pacific not only supplied the Pullmans but also a special diner and club car, with a Union Pacific chef catering to the palates of a hard-working group of troupers.

Multiple Tunnels

On the line of the Austrian State Railways in the mountains of the Tyrol, a tunnel through a mountain on the line from Bad Gastein to St. Veid crosses over another tunnel lower down in the mountain, on the line between Vienna and Innsbruck. This is one of the few cases, if not the only one, where two tunnels through the same mountain are superimposed. If there are any in the United States, this department would like to hear about them. Incidentally, on the first mentioned line, there are 24 tunnels, including one over two miles long, in a distance of 72 miles. If memory serves us correctly, this is just about the record, since the main line of the Southern (C., N. O. & T. P.) was rebuilt from Somerset, Ky., to Oakdale, Tenn., a decade or two ago, and a number of tunnels were eliminated.

The Record Lackawanna Veteran

Richard McHale, aged 79, of Scranton, Pa., holds the record for length of service of all those whose names have appeared on the Delaware, Lackawanna & Western pay roll. When Mr. McHale was presented with an engraved certificate signed by the chairman of the pension board and the railroad's president recently and he was retired on pension, he had completed 68 years and 8 months of service without a single demerit mark. He entered Lackawanna service at the age of 10 as a breaker boy in the anthracite mines of what was then the coal mining department of the railroad, graduating to mule driver and to brakeman on express, milk and freight trains. Since his seventieth birthday Mr. McHale has served the railroad as a watchman.

Moving Monuments

Few living men have monuments erected in their honor. Still fewer live to see all-steel coaches or Pullman cars named after them. Only six men in the United States can see a railroad coach named after them. All but one of these are on the Great Northern's Empire Builder. The six living men with cars named in their honor are: Col. Charles A. Lindbergh, George F. Baker, John F. Stevens, Gen. W. C. Brown, Gen. Hugh S. Scott, and George B. Winship. The "Lindbergh" is used on the Pennsylvania and the others on the Great Northern. Mr. Baker is the internationally known financier and capitalist; Mr. Stevens, the engineer and former chief engineer of the Great Northern as well as of the Panama canal; General Brown is a retired army officer who played an important part in Indian affairs throughout the west, and Mr. Winship formerly was the publisher of the Grand Forks (N. D.) Herald, who now lives in San Diego, Cal. The Great Northern, in naming its Empire Builder cars, used names of men who have played an important part in the development of the northwest. No living man's name is used on a car without his permission, and the Pullman Company has a rule that no name of any car shall be duplicated.

The Creights of the Southern

Shippers and receivers of freight at Winnsboro, S. C., on the Columbia division of the Southern, have been dealing with "Agent Creight" for nearly 80 years. John J. Creight, the present agent, and his father, the late W. B. Creight, before him have served the Southern and its predecessor companies as agent at Winnsboro ever since the line of the Charlotte & South Carolina was completed from Columbia, S. C., to Charlotte, N. C., late in the autumn of 1852. When the railroad was built into Winnsboro, the elder Mr. Creight was installed as agent. He saw the line wrecked and most of the buildings in Winnsboro and the surrounding country burned by Sherman's army during the Civil War. From bricks from chimneys that were left standing he helped put up a building that is still serving as part of the present station. He served with the Charlotte & South Carolina until it was merged into the Charlotte, Columbia & Augusta in 1869; with that company until its line was released to the Richmond & Danville in 1886; with the R. & D. until the organization of the Southern Railway Company in July, 1894; and with the Southern until his death in February, 1904. John J. Creight, the present agent, after acting as clerk at Winnsboro for 20 years, was promoted to agent on the death of his father.

NEWS *of the* WEEK

The Boston & Maine's "Minute Man," with locomotive "William Dawes," at Waltham, Mass.

A COMPLAINT of the Brotherhood of Locomotive Firemen and Enginemen against the operation of gas-electric rail cars by the Wheeling & Lake Erie on its Toledo-Zanesville line without "full crews" was dismissed by the Public Utilities Commission of Ohio on June 17.

THE NUMBER OF EMPLOYEES of Class I railways as of the middle of the month of April was 1,572,567, according to a preliminary statement issued by the Interstate Commerce Commission. This is a decrease of 5.59 per cent as compared with April, 1929, and of 5.19 per cent as compared with April, 1928.

THE SOUTHERN PACIFIC has announced that it will not appeal the decision of the Interstate Commerce Commission authorizing the Great Northern and Western Pacific to construct a connection between their lines in California and Oregon. The Southern Pacific was the chief intervenor when the two roads applied to the Commission for authority to construct the line.

SENATOR HOWELL, of Nebraska, introduced in the Senate on June 23 a Senate resolution proposing the appointment of a special select committee of three Senators to investigate the operations, economic situation and prospects of the Alaska Railroad and to report to Congress with its recommendations for legislation. The committee, or a sub-committee, is authorized to hold hearings in the United States and in Alaska, during the sessions or recess of the Senate.

Southern New England Lands Sold

At Providence, R. I., on June 18, the right of way of the Southern New England, within the state of Rhode Island, excepting certain terminal grounds, was sold at auction for $150,000. The purchaser was the Brooksay Realty Company, a concern said to have been organized in the interest of the Providence Chamber of Commerce, as a part of the plan of the Chamber to secure the completion of this proposed line, from Providence northwestward to Palmer, Mass. The line, which was begun by the Grand Trunk in 1910, was, a dozen years ago, left unfinished after the expenditure on it of about $7,000,000. Reports say that the receivers of the Southern New England have received a certified check for $7,500 from the bidder.

Bus Bill Taken Up in Senate

The Parker bill to provide for the regulation of interstate bus transportation, as amended by the Senate committee on interstate commerce, was made the unfinished business of the Senate on June 23 and was debated for a time on June 24. Senator Dill, of Washington, at once began a fight against the provision in the bill which requires a certificate of public convenience and necessity. He also objected to the provision making the issuance of such a certificate mandatory when there is only one line operating over a given route.

Greyhound Offices in Cleveland

The general offices of the Greyhound Management Company and the Greyhound Lines, the largest motor coach operating company in the east and central west, and the company in which the Pennsylvania has a substantial interest, have been transferred from Chicago to Cleveland, Ohio. Several floors of the Insurance Center Building, at East 11th Street and Walnut Avenue, in Cleveland have been leased. The offices of President O. S. Ceasar and other general officers of the company were transferred to Cleveland in order that they might be situated closer to the center of operations of the system.

Bill to Authorize More Suits Against I.C.C.

Senator Couzens has introduced in the Senate a bill to amend section 16a of the interstate commerce act to enable shippers or any party to a proceeding before the Interstate Commerce Commission to bring suit in any district court to set aside any order of the commission by which such party is aggrieved, including any order denying any petition or other negative order, upon the ground that no substantial evidence has been presented in such proceeding upon which to base such an order, or upon the ground that the order is contrary to law, or that the commission has failed to exercise jurisdiction or perform a duty imposed upon it by law.

Harriman Medals for 1929

The Harriman medals, awarded annually by the American Museum of Safety to railroads making the best records in saving life and limb, were delivered at a dinner in New York City on June 24. The gold medal for 1929 went to the Oregon Short Line and was delivered to H. J. Plumhof, general manager; the silver medal to the Oregon-Washington Railroad & Navigation Company, delivered to J. P. O'Brien, general manager; and the bronze medal, awarded to the Nevada Northern, was delivered to E. V. Daveler, treasurer.

Court Upholds I.C.C. in Texas Rate Case

A three-judge federal court at Galveston, Tex., on June 17, dismissed suits brought by the Texas & Pacific and the Louisiana & Arkansas to enjoin the Interstate Commerce Commission from placing in effect an order prohibiting an equality of rates between points in Northern Texas and Galveston, Tex., and Northern Texas points and New Orleans, La. In a series of three decisions, the commission has held in favor of Texas ports by prescribing rates favorable to them from Texas, Oklahoma and Southern Kansas when the distance to New Orleans is 25 per cent greater than the short line distance to Galveston. These rates have been in effect since December, 1927, except from points on the Texas & Pacific and the Louisiana & Arkansas, which asked that they be excluded from the general order. Their petition was denied but the effective date of the order was postponed until disposition of the appeal in the courts.

C. & N. W. Talking Pictures

A test of the practicability of presenting talking motion pictures on a moving train was made by the Chicago & North

Western on the regular trip of "The Viking," between Chicago and Waukegan, Ill., on June 18. The presentation was characterized as a success by a group of 30 representatives of Chicago newspapers, motion picture interests and the railroad men who witnessed it. A regular coach, with dark curtains over the windows and a screen at one end of the car, was utilized for the experiment. The smoking compartment served as the projection booth and a portable projector with sound attachment was installed on a raised platform, while the speaker was located in the ceiling of the car. The cost of installing such equipment in a railway car, exclusive of the expense of remodeling the coach, is estimated at $5,000.

Los Angeles and New Orleans Station Cases Continued

The Atchison, Topeka & Santa Fe, the Southern Pacific and the Los Angeles & Salt Lake on June 16 filed a petition with the California Supreme court asking for a rehearing of the case decided on May 27 wherein the court upheld the authority of the State Railroad Commission to order the construction of the Plaza Union station at Los Angeles, Cal.

The Illinois Central, which had been ordered to submit plans for its proposed new station at New Orleans, La., on June 17, has been granted a continuance by the Louisiana Public Service Commission. The road pleaded that plans for a new union passenger station cannot be completed until an agreement on the selection of a site is reached with the New Orleans city council.

Rivers and Harbors Bill Passed

The rivers and harbors authorization bill was passed by the Senate on June 20, after the Senate had adopted amendments adding some $28,000,000 to the $116,000,000 estimated cost of the projects authorized by the bill as it passed the House, making a total of $144,000,000, and a conference report on the bill, including most of the Senate amendments, was adopted by both houses of Congress on June 24, so that the bill was sent to the President for his approval.

The opposition of the advocates of a St. Lawrence river sea-way to the provision authorizing the federal government to take over and operate the Erie and Oswego canals if the state of New York decides to transfer them was overcome by amendments providing that they shall be taken over as barge canals and that no project for widening or deepening them shall proceed without subsequent authorization by Congress, although some of the Senators pointed out that this affords no certainty that the agitation to convert the canals into ship canals will not be revived as soon as they are in the hands of the federal government. An amount of $7,500,000 additional was authorized for improvements on the upper Mississippi river as part of the plan for obtaining a nine-foot depth, without definite commitment to the entire 9-foot project on which the Board of Engineers for Rivers and Harbors has not submitted its final report. For the Missouri river between Kansas City and Sioux City the bill as passed by the Senate authorizes $15,000,000 in addition to the unexpected balance of funds previously authorized. The sum of $7,500,000 was authorized for the completion of the Illinois waterway, which is to be taken over by the federal government, after a long debate as to the amount of water to be diverted from Lake Michigan. The Secretary of War is directed to have a study made as to the minimum amount of flow required to meet the needs of the waterway without substantially injuring navigation on the Great Lakes and report to Congress before January 31, 1938.

Senator Vandenburg, of Michigan, said that the authorizations included in the bill are "beyond all rational limits" and involve ultimate commitments amounting to nearly $335,000,000, as compared with a total of $225,000,000 expended for new work on rivers and harbors in the eight years from 1922 to 1929, inclusive, and that at that rate of expenditure the authorizations and ultimate commitments would exhaust the annual appropriations for rivers and harbors for the next 12 years without another rivers and harbors bill. The War Department appropriation bill for 1931 carries a total of $55,000,000 for rivers and harbors. "We are a rich nation," said Senator Vandenburg, "but even a rich nation must cut its garment to fit its cloth, though the cloth be cloth of gold."

He also pointed out that many of the authorizations do not yet bear the final recommendation of the board of engineers. Senator Vandenburg, however, is one of the prominent advocates of still greater expenditures for the St. Lawrence ship canal.

Pennsylvania Extends Electric Operation

Coincident with the change to its summer time-table, which goes into effect on Sunday, June 29, the Pennsylvania will inaugurate electric operation of all suburban and local passenger trains between Philadelphia, Pa., and Trenton, N. J., approximately 33 miles. The new service will shorten train runs from 5 to 18 minutes, materially quickening local service between the two cities. Schedules of 20 trains will be reduced by a total of 232 minutes, an average saving of over 11½ minutes per train.

As in the case of the electric suburban service established between Philadelphia and Wilmington, Del., in September, 1928, the new service will be confined, for the time being, to passenger trains only. Operation of freight trains by electric power will be started with the completion of the Pennsylvania's entire program of electrification, which includes the main line from New York to Washington and low grade freight lines between eastern terminals and Susquehanna Valley points. The work of electrifying the four running tracks between North Philadelphia and Trenton, a distance of about 28 miles, was started approximately one year ago and forms an integral part of the general electrification project.

Traffic

The Kansas City, Mexico & Orient extension from San Angelo, Tex., to Sonora, 68 miles, will be opened for operation by the Panhandle & Santa Fe on July 1.

The Pennsylvania announces that single room sleeping cars—each room with a full size bed—will be included in the equipment of the Broadway Limited between New York and Chicago, beginning June 29. The same improvement will soon be added to the Liberty Limited, between Washington and Chicago.

H. M. Remington has been appointed manager of the Transportation Department of the San Francisco (Cal.) Chamber of Commerce, in place of Seth Mann, who has retired from active service, though still retaining his connection with the Chamber as a consultant.

Eighteen thousand boys and girls are expected by the Boston & Maine to use its trains during this and next week on their way to summer camps in northern New England. It is estimated that there will this year be about 516 such camps, and the transportation of these passengers will call for the use of 500 extra sleeping cars and day coaches.

The Chicago, Milwaukee, St. Paul & Pacific is to operate 10 special conducted-tour trains from Chicago to Seattle, Wash., Tacoma and Mt. Rainier, departing from Chicago on 10 consecutive Sundays. The first train left Chicago on June 22. Stops will be made at Kilbourn, Wis., Wakpala, S. D., and Spokane, Wash., to visit points of interest.

The Interstate Commerce Commission has issued a certificate under the Denison amendment to the inland waterways act authorizing the Beardslee Launch & Barge Service, Inc., to engage in the transportation of lumber and forest products from Service, Ala., on the Tombigbee and Mobile rivers to Mobile, Ala., and has required the connecting rail carriers to join with it in through routes and joint rates from Service, Ala., to Ohio and Mississippi river crossings.

The Pennsylvania announces material reductions in one-day excursion fares from both New York City and Philadelphia, to seashore resorts in North Jersey. These excursions, heretofore operated on certain days, are now to be run daily from Philadelphia and on at least two days in the week from New York. Similar excursions will be run from the seashore resorts to New York. A typical reduction is that of 35 cents from Philadelphia to Asbury Park.

Montana Commission Sustained

The right of the Montana Board of Railroad Commissioners to fix intrastate freight rates, before action by the Interstate Commerce Commission, was upheld in a decision of a three-judge statutory court in the federal district

(*Continued on page 1610*)

Operating Statistics of Large Steam Railways—Selected Items for April, 1930, Comp

Region, road and year	Average miles of road operated	Train-miles	Locomotive-miles: Principal and helper	Locomotive-miles: Light	Car-miles: Loaded (thousands)	Car-miles: Per cent loaded	Ton-miles (thousands): Gross, Excluding locomotives and tenders	Ton-miles (thousands): Net, Revenue and non-revenue	Average number of locomotives on line: Serviceable	Unserviceable	Per cent unserviceable	Stored
New England Region:												
Boston & Albany 1930	407	179,732	190,481	19,028	4,550	65.5	236,411	82,472	101	22	17.6	40
1929	407	199,770	210,992	19,248	5,103	68.0	258,033	93,955	102	19	15.3	33
Boston & Maine 1930	2,066	361,944	414,847	55,862	12,549	70.2	646,758	237,834	239	56	18.8	61
1929	2,070	397,646	465,674	50,443	13,503	72.8	665,953	258,759	269	38	12.4	57
N. Y., New H. & Hart. 1930	2,104	433,449	503,206	30,933	15,139	64.2	814,686	298,738	283	61	17.8	46
1929	2,102	506,376	573,582	40,795	16,564	69.7	845,290	334,458	280	83	22.9	14
Great Lakes Region:												
Delaware & Hudson 1930	875	289,654	392,164	48,602	9,978	64.0	596,459	272,234	244	27	10.0	105
1929	875	326,735	434,044	42,570	10,699	66.2	622,253	294,701	236	29	10.8	77
Del., Lack. & Western 1930	998	454,244	502,160	56,178	15,610	66.4	878,182	348,553	238	56	19.0	37
1929	998	539,751	607,622	69,979	18,973	66.7	1,062,826	434,650	241	55	18.5	8
Erie (inc. Chi. & Erie) 1930	2,316	799,126	859,425	59,825	35,272	61.7	2,097,313	804,174	406	96	19.1	95
1929	2,316	852,672	929,162	71,575	39,132	64.5	2,269,940	920,073	399	98	19.6	44
Grand Trunk Western 1930	1,020	297,864	301,348	3,212	8,881	66.5	482,113	177,348	91	36	28.3	24
1929	992	376,193	378,295	1,758	11,665	66.2	630,812	232,109	118	23	16.1	...
Lehigh Valley 1930	1,343	475,265	516,241	57,791	14,859	65.1	864,881	355,733	259	86	24.9	31
1929	1,343	526,064	578,242	65,088	17,627	66.2	1,012,339	431,954	298	99	24.9	53
Michigan Central 1930	1,865	504,700	506,614	14,481	17,164	59.7	967,224	319,587	168	53	24.0	36
1929	1,822	599,152	605,655	17,985	22,043	62.5	1,176,090	386,226	194	40	17.1	19
New York Central 1930	6,468	1,873,590	2,049,428	139,661	72,032	60.6	4,349,374	1,760,370	1,046	315	23.1	353
1929	6,467	2,015,301	2,269,985	164,398	80,996	62.1	4,799,949	1,968,646	944	369	28.1	170
New York, Chi. & St. L. 1930	1,665	619,683	627,826	6,447	19,831	61.1	1,154,015	420,314	200	59	22.9	33
1929	1,665	643,560	650,627	7,496	21,719	63.7	1,206,945	448,564	209	61	22.7	32
Pere Marquette 1930	2,177	416,738	421,441	4,785	10,567	63.6	622,081	248,307	169	29	14.5	33
1929	2,178	444,490	447,959	5,340	11,510	63.7	672,614	286,173	176	36	17.0	8
Pitts. & Lake Erie 1930	231	114,461	115,529	1,426	4,221	60.5	333,800	185,768	51	13	20.8	17
1929	231	127,314	128,617	1,312	4,887	63.3	374,318	213,281	53	13	19.4	13
Wabash 1930	2,497	780,523	826,568	12,267	24,091	62.7	1,389,045	484,561	313	68	17.7	49
1929	2,497	855,270	888,807	10,794	25,455	63.1	1,447,672	514,700	283	74	20.7	15
Central Eastern Region:												
Baltimore & Ohio 1930	5,541	1,680,253	1,947,913	239,707	52,847	61.7	3,488,870	1,577,129	981	184	15.8	157
1929	5,536	1,926,055	2,189,445	268,152	58,404	63.5	3,757,347	1,742,671	1,015	194	16.0	114
Central of New Jersey 1930	693	254,622	275,893	42,595	7,344	58.1	487,645	219,131	162	35	17.6	17
1929	691	272,730	294,001	45,428	8,117	58.6	538,109	246,896	176	33	15.9	26
Chicago & Eastern Ill. 1930	946	217,062	217,762	2,386	5,848	62.8	354,842	150,457	89	48	34.9	25
1929	946	228,562	229,218	2,640	6,373	65.4	369,496	155,461	85	74	46.6	20
Big Four Lines a 1930	2,712	738,593	761,921	17,869	22,717	60.6	1,445,917	640,222	304	152	33.3	30
1929	2,718	754,799	782,202	19,051	24,571	63.5	1,504,259	668,523	364	127	25.9	62
Elgin, Joliet & Eastern 1930	453	129,793	140,999	5,848	3,628	63.7	272,979	142,006	78	13	14.3	4
1929	453	137,752	145,718	6,390	4,075	64.6	301,392	156,876	76	11	12.5	2
Long Island 1930	400	44,958	49,718	12,574	555	54.3	39,087	15,115	50	5	9.5	2
1929	400	48,142	53,724	15,821	646	56.2	42,170	15,850	53	9	14.2	...
Pennsylvania System 1930	10,690	3,536,461	4,035,527	397,899	127,657	62.5	8,375,945	3,711,954	2,402	316	11.6	676
1929	10,738	3,879,861	4,461,615	415,966	140,786	65.0	9,121,718	4,216,792	2,700	264	8.9	741
Reading 1930	1,454	588,537	640,988	55,589	16,115	58.9	1,135,284	542,149	325	59	15.3	60
1929	1,452	624,174	685,800	50,219	17,350	61.8	1,151,978	555,195	342	65	15.9	48
Pocahontas Region:												
Chesapeake & Ohio 1930	2,740	955,508	1,010,891	38,656	34,472	57.9	2,758,764	1,484,597	518	81	13.5	118
1929	2,730	990,849	1,055,876	38,355	34,194	57.8	2,661,414	1,416,303	529	101	16.1	92
Norfolk & Western 1930	2,230	754,069	857,857	46,118	28,356	59.7	2,317,595	1,217,566	448	47	9.4	123
1929	2,230	788,946	892,990	33,782	30,449	60.6	2,447,423	1,299,035	475	55	10.4	125
Southern Region:												
Atlantic Coast Line 1930	5,155	666,053	670,115	8,890	16,846	60.5	938,743	331,827	399	62	13.4	88
1929	5,153	813,132	819,216	10,788	22,518	58.9	1,241,769	428,015	438	54	10.9	67
Central of Georgia 1930	1,900	267,303	269,193	4,802	6,523	69.3	355,372	146,590	125	27	18.0	6
1929	1,900	299,356	302,861	5,218	7,609	71.4	405,936	170,642	133	19	12.5	8
Ill. Cent. (inc. Y. & M. V.) 1930	6,694	1,749,902	1,762,949	29,949	46,660	60.4	3,061,710	1,206,120	707	128	15.3	31
1929	6,710	1,934,366	1,953,653	29,292	52,702	62.5	3,321,054	1,332,507	725	107	12.9	26
Louisville & Nashville 1930	5,242	1,453,590	1,537,980	45,014	31,471	58.7	2,171,774	1,006,553	564	125	18.2	82
1929	5,247	1,566,533	1,648,919	52,616	34,188	61.1	2,257,028	1,050,697	603	104	14.7	57
Seaboard Air Line 1930	4,484	574,944	595,441	7,260	14,553	62.4	836,348	310,806	268	28	9.5	1
1929	4,475	653,323	680,860	7,771	17,085	60.8	1,003,053	352,385	260	45	14.8	...
Southern 1930	6,676	1,396,879	1,426,418	27,461	34,868	63.4	1,986,881	771,460	796	155	16.3	162
1929	6,679	1,564,542	1,599,433	36,168	39,647	64.7	2,189,158	869,179	829	127	13.3	99
Northwestern Region:												
Chi. & North Western 1930	8,459	1,268,481	1,339,261	26,009	33,488	62.1	1,967,779	718,132	761	91	10.6	155
1929	8,467	1,347,081	1,412,632	23,306	34,552	62.0	2,022,005	760,145	733	111	13.1	105
Chi., Milw., St. P. & Pac. 1930	11,350	1,525,639	1,619,253	86,544	44,495	62.4	2,669,075	1,085,901	798	156	16.3	255
1929	11,244	1,564,773	1,681,296	99,757	47,553	64.2	2,751,652	1,134,348	775	158	16.9	184
Chi., St. P., Minn. & Om. 1930	1,724	272,139	292,502	11,378	5,759	65.3	319,627	125,358	150	28	15.7	48
1929	1,724	283,282	301,464	12,967	6,071	66.0	325,314	127,413	141	31	17.8	25
Great Northern 1930	8,338	713,878	727,334	35,289	24,551	67.8	1,402,038	623,344	455	151	24.9	66
1929	8,378	798,867	821,721	48,346	28,828	66.8	1,693,136	783,738	480	148	23.6	63
Minn., St. P. & S. St. M. 1930	4,388	396,032	408,390	5,066	11,117	67.6	591,962	243,160	180	47	20.9	29
1929	4,357	462,819	478,380	5,096	13,525	69.1	715,599	311,660	202	46	18.7	25
Northern Pacific 1930	6,468	660,152	700,393	45,398	22,229	73.1	1,183,382	522,248	405	121	23.0	65
1929	6,476	751,950	795,426	49,611	27,037	72.4	1,448,022	644,855	436	124	22.1	58
Oreg.-Wash. R. R. & Nav. 1930	2,246	173,929	182,304	11,087	4,946	67.5	284,287	117,607	115	21	15.1	34
1929	2,246	194,577	202,656	13,700	5,594	68.9	318,148	137,084	117	16	11.7	23
Central Western Region:												
Atch., Top. & S. Fe (incl. P. & S. F.) 1930	11,200	1,670,458	1,805,674	76,924	53,714	65.0	3,147,419	1,139,789	779	147	15.9	245
1929	11,154	1,780,306	1,926,904	90,689	57,934	63.4	3,417,278	1,196,327	816	157	16.1	200
Chicago & Alton 1930	1,000	251,737	263,799	3,030	6,155	58.7	392,600	148,664	128	19	13.1	27
1929	1,000	278,025	297,187	3,512	7,048	59.2	431,437	166,476	124	24	16.0	20
Chi., Burl. & Quincy 1930	9,275	1,273,079	1,335,736	53,351	40,502	62.5	2,338,217	1,017,584	641	146	18.6	65
1929	9,317	1,369,722	1,423,408	49,385	43,517	63.9	2,480,403	1,091,636	703	163	18.8	64
Chi., Rock I. & Pacific 1930	7,593	1,341,781	1,391,806	10,523	33,380	57.6	2,106,405	770,107	532	113	17.5	84
1929	7,564	1,460,250	1,520,889	15,834	35,642	60.9	2,113,923	793,309	533	136	20.4	31
Denver & R. G. Wn. 1930	2,562	204,324	235,354	32,865	5,862	68.3	344,793	153,996	199	44	17.9	48
1929	2,548	216,548	248,457	36,367	6,634	68.4	396,024	186,828	212	49	18.6	37
Oregon Short Line 1930	2,538	256,481	266,008	16,907	7,614	67.1	447,698	184,617	170	14	7.4	74
1929	2,539	287,086	297,638	21,408	8,768	67.7	517,368	221,387	177	6	3.2	62
So. Pacific—Pacific Lines 1930	8,957	1,404,602	1,524,469	222,306	44,155	60.6	2,768,926	974,407	695	211	23.3	141
1929	8,725	1,520,198	1,649,619	208,291	47,993	63.0	2,949,287	1,107,832	664	241	26.7	67
Union Pacific 1930	3,765	835,022	853,409	32,752	34,620	70.6	1,856,947	708,032	391	58	13.0	135
1929	3,765	899,494	924,610	44,986	35,050	68.6	1,909,617	733,983	376	64	14.6	91
Southwestern Region:												
Gulf, Colo. & S. Fe 1930	1,932	236,231	250,318	5,264	7,812	66.1	483,274	212,336	102	20	16.1	20
1929	1,933	245,679	255,195	9,952	7,871	67.3	464,772	199,860	110	21	16.3	22
Mo.-Kans.-Texas Lines 1930	3,176	374,490	380,662	7,340	11,798	58.2	720,793	271,466	185	57	23.6	87
1929	3,176	431,154	436,953	12,818	14,604	58.5	872,857	322,773	194	55	22.2	79
Missouri Pacific 1930	7,424	1,370,819	1,414,652	35,472	41,204	62.2	2,533,040	999,193	520	87	14.4	132
1929	7,433	1,397,793	1,455,132	45,428	41,451	63.2	2,477,871	987,327	522	84	13.9	122
St. Louis-San Francisco 1930	5,223	755,803	767,394	10,146	19,126	59.5	1,167,253	452,314	358	69	16.2	21
1929	5,213	836,660	849,183	8,776	20,034	61.3	1,192,739	470,807	391	71	15.3	36
Texas & New Orleans 1930	4,701	694,643	696,827	1,594	16,098	61.0	987,276	362,192	279	56	16.8	65
1929	4,709	866,767	870,057	1,639	19,084	62.3	1,148,942	433,279	292	54	15.6	40
Texas & Pacific 1930	1,951	442,140	442,140	3,216	12,127	56.2	807,111	288,073	200	32	13.7	36
1929	2,015	502,313	502,324	7,414	13,439	56.3	884,800	326,286	186	26	12.3	20

a Includes Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati Northern, and Evansville, Indianapolis & Terre Haute.

Compiled by Bureau of Statistics, Interstate Commerce Commission. Subject to revision.

ared with April, 1929, for Roads with Annual Operating Revenues above $25,000,000.

Region, road and year	Average number of freight cars on line: Home	Foreign	Total	Per cent unserviceable	Gross ton-miles per train-hour, excluding locomotives and tenders	Gross ton-miles per train-mile, excluding locomotives and tenders	Net ton-miles per train-mile	Net ton-miles per loaded car-mile	Net ton-miles per car-day	Car-miles per car-day	Net ton-miles per mile of road per day	Pounds of coal per 1,000 gross ton-miles, including locomotives and tenders	Locomotive-miles per locomotive-day
New England Region:													
Boston & Albany.....1930	4,138	3,841	7,979	4.8	19,675	1,315	459	18.1	345	29.0	6,752	158	56.8
1929	3,011	5,143	8,154	6.1	18,459	1,292	470	18.4	384	30.7	7,693	165	63.6
Boston & Maine.....1930	11,433	10,442	21,875	4.3	22,972	1,787	657	19.0	362	27.2	3,837	106	53.2
1929	9,713	12,066	21,779	3.3	20,641	1,675	651	19.2	396	28.4	4,168	113	56.1
N. Y., New H. & Hart..1930	16,846	13,532	30,378	11.5	24,733	1,880	689	19.7	328	25.9	4,732	108	51.7
1929	15,317	17,220	32,537	9.4	21,706	1,669	660	20.2	343	24.3	5,304	113	56.3
Great Lakes Region:													
Delaware & Hudson.....1930	11,088	5,077	16,165	3.8	26,401	2,059	940	27.3	561	32.1	10,368	127	54.3
1929	9,092	6,015	15,107	4.0	23,897	1,904	902	27.5	650	35.7	11,227	136	60.0
Del., Lack. & Western...1930	19,277	6,687	25,964	4.3	25,495	1,933	767	22.3	447	30.2	11,640	137	63.5
1929	16,880	8,726	25,606	5.3	24,990	1,969	865	22.9	566	37.0	14,515	132	76.4
Erie (inc. Chi. & Erie)..1930	34,920	15,749	50,669	4.1	36,333	2,625	1,006	22.8	529	37.6	11,574	107	61.0
1929	29,387	19,238	48,625	4.1	34,026	2,662	1,079	23.5	631	41.6	13,242	113	67.1
Grand Trunk Western...1930	3,784	10,474	14,258	6.7	24,321	1,619	595	20.0	415	31.2	5,798	108	79.7
1929	2,687	15,996	18,683	4.5	22,324	1,677	617	19.9	414	31.4	7,803	97	90.4
Lehigh Valley 1930	20,040	6,956	26,996	6.5	27,252	1,820	748	23.9	439	28.2	8,830	146	55.6
1929	20,594	8,716	29,310	10.4	26,927	1,924	821	24.5	491	30.3	10,718	145	54.1
Michigan Central.....1930	23,510	13,021	36,531	5.2	34,989	1,916	633	18.6	292	26.2	5,711	110	78.7
1929	16,099	16,926	33,025	5.6	32,640	1,963	645	17.5	390	35.6	7,066	108	88.8
New York Central.....1930	76,092	63,105	139,197	4.4	32,631	2,321	940	24.4	422	28.5	9,073	103	53.6
1929	68,263	70,307	138,570	5.3	31,906	2,382	977	24.3	474	31.4	10,147	105	61.8
New York, Chi. & St. L..1930	14,864	9,244	24,108	7.9	28,748	1,862	678	21.2	581	44.9	8,416	102	81.4
1929	13,091	9,966	23,057	6.3	27,209	1,875	697	20.7	648	49.3	8,982	104	81.0
Pere Marquette 1930	8,408	7,105	15,513	3.3	22,348	1,493	596	23.5	534	35.7	3,802	100	72.0
1929	9,345	8,281	17,626	3.6	20,346	1,513	644	24.9	541	34.2	4,380	101	71.3
Pitts. & Lake Erie.....1930	15,466	6,052	21,518	5.3	38,963	2,916	1,623	44.0	288	10.8	26,782	101	60.5
1929	13,588	8,955	22,543	9.5	34,927	2,940	1,675	43.6	315	11.4	30,741	102	66.2
Wabash 1930	17,369	11,791	29,160	2.7	30,307	1,780	621	20.1	554	43.9	6,470	113	73.5
1929	14,778	13,779	28,557	2.3	27,802	1,693	602	20.2	601	47.1	6,872	120	83.9
Central Eastern Region:													
Baltimore & Ohio.....1930	77,565	24,790	102,355	5.5	25,389	2,076	939	29.8	514	27.9	9,488	141	62.6
1929	71,923	30,513	102,436	6.2	23,004	1,951	905	29.8	567	29.9	10,492	144	67.8
Central of New Jersey...1930	17,704	9,728	27,432	5.3	24,569	1,915	861	29.8	266	15.4	10,545	148	53.9
1929	17,496	10,763	28,259	5.9	23,319	1,973	905	30.4	291	16.3	11,918	147	54.2
Chicago & Eastern Ill....1930	13,000	3,649	16,649	42.2	27,052	1,635	693	25.7	301	18.6	5,300	128	53.4
1929	13,116	3,762	16,878	37.8	24,623	1,617	680	24.4	307	19.2	5,476	134	48.7
Big Four Lines a 1930	25,844	21,711	47,555	4.5	29,189	1,958	867	28.2	469	26.3	7,870	113	57.1
1929	23,192	22,024	45,216	5.0	27,811	1,993	886	27.2	493	28.5	8,200	115	54.4
Elgin, Joliet & Eastern..1930	9,574	7,311	16,885	4.4	15,204	2,103	1,094	39.1	280	14.2	10,453	121	53.8
1929	9,138	7,571	16,709	5.9	15,949	2,188	1,139	38.5	313	12.6	11,538	127	58.3
Long Island 1930	759	4,843	5,602	1.3	6,416	869	336	27.2	90	6.1	1,259	317	37.3
1929	1,069	5,981	7,050	1.5	5,960	876	329	24.5	75	5.4	1,320	313	37.4
Pennsylvania System.....1930	225,572	70,586	296,158	3.3	29,884	2,368	1,050	29.1	418	23.0	11,575	124	54.4
1929	214,211	82,793	297,004	5.3	28,636	2,351	1,087	30.0	473	24.3	13,090	121	54.9
Reading 1930	31,813	11,392	43,205	4.7	22,126	1,929	921	33.6	418	21.1	12,429	144	60.5
1929	28,872	13,646	42,518	3.8	20,894	1,846	889	32.0	435	22.0	12,745	150	60.3
Pocahontas Region:													
Chesapeake & Ohio.....1930	31,859	9,088	40,947	2.2	37,485	2,887	1,554	43.1	1,209	48.5	18,059	84	58.5
1929	32,704	9,671	42,375	2.5	34,291	2,686	1,429	41.4	1,114	46.6	17,293	86	57.9
Norfolk & Western.....1930	34,916	7,714	42,630	1.0	42,496	3,073	1,615	42.9	952	37.1	18,200	117	60.8
1929	31,303	8,244	39,547	1.2	42,545	3,102	1,647	42.7	1,095	42.4	19,417	123	58.2
Southern Region:													
Atlantic Coast Line.....1930	24,532	9,602	34,134	4.5	21,131	1,409	498	19.7	324	27.2	2,146	110	49.1
1929	20,869	12,274	33,143	5.2	21,662	1,527	526	19.0	430	38.4	2,769	105	56.3
Central of Georgia.....1930	5,913	3,607	9,520	6.9	19,314	1,329	548	22.5	513	33.0	2,572	127	60.1
1929	4,833	5,708	10,541	5.8	18,556	1,356	570	22.4	540	33.7	2,994	133	67.6
Ill. Cent. (inc. Y. & M. V.)1930	46,430	18,171	64,601	4.7	25,553	1,750	689	25.8	622	39.9	6,006	129	71.6
1929	40,942	21,394	62,336	4.8	24,813	1,717	689	25.3	713	45.1	6,619	128	79.5
Louisville & Nashville....1930	47,261	12,352	59,613	7.8	20,814	1,494	692	32.0	563	30.0	6,401	144	76.6
1929	45,603	17,923	63,526	8.2	18,484	1,441	671	30.7	551	29.4	6,675	146	80.2
Seaboard Air Line.....1930	15,275	8,583	23,858	2.7	19,323	1,455	541	21.4	434	32.6	2,310	127	68.0
1929	14,607	11,466	26,073	6.3	19,542	1,535	539	20.6	451	35.9	2,625	127	75.4
Southern 1930	53,442	16,913	70,355	11.4	20,429	1,422	552	22.1	366	26.1	3,852	149	51.0
1929	47,540	21,142	68,682	9.6	19,794	1,399	556	21.9	422	29.7	4,338	153	57.0
Northwestern Region:													
Chi. & North Western...1930	50,399	24,096	74,495	6.3	20,871	1,551	566	21.5	321	24.1	2,830	129	53.5
1929	46,352	25,670	72,022	7.2	19,310	1,501	564	22.0	352	25.8	2,993	133	56.8
Chi., Mil., St. P. & Pac..1930	55,196	18,053	73,249	3.0	23,785	1,749	712	24.4	494	32.4	3,189	123	59.6
1929	49,247	21,627	70,874	3.1	22,724	1,758	725	23.9	534	34.8	3,363	130	63.6
Chi., St. P., Minn. & Om..1930	2,447	8,371	10,818	6.6	15,931	1,174	461	21.8	386	27.2	2,424	122	57.1
1929	2,577	8,693	11,270	6.7	14,832	1,148	450	21.0	377	27.2	2,464	123	60.9
Great Northern 1930	42,145	7,620	49,765	5.6	24,810	1,964	873	25.4	418	24.2	2,492	127	42.0
1929	38,955	10,738	49,693	6.2	25,666	2,119	981	27.2	526	28.9	3,118	130	46.2
Minn., St. P. & S. St. M..1930	19,616	4,505	24,121	3.4	19,282	1,495	614	21.9	337	22.8	1,847	103	60.7
1929	19,110	5,483	24,593	4.7	18,590	1,546	673	23.0	426	26.8	2,384	103	65.0
Northern Pacific.....1930	40,921	5,662	46,583	8.1	25,009	1,793	791	23.5	374	21.8	2,692	140	47.3
1929	37,272	6,792	44,064	9.4	24,950	1,927	858	23.9	488	28.2	3,319	149	50.4
Ore.-Wash. R.R. & Nav..1930	8,196	2,805	11,001	5.8	23,530	1,635	676	23.8	356	22.2	1,746	157	47.4
1929	8,000	3,653	11,653	7.4	22,589	1,635	705	24.5	392	23.2	2,035	167	54.2
Central Western Region:													
Atch., Top. & S. Fe (incl. 1930	69,807	16,006	85,813	6.6	30,430	1,884	682	21.2	443	32.1	3,392	106	67.8
P. & S. F.).....1929	55,790	17,589	73,379	6.5	29,770	1,919	672	20.6	543	41.5	3,575	111	69.1
Chicago & Alton.....1930	10,578	4,585	15,163	5.2	25,086	1,560	591	24.2	327	23.1	4,957	133	60.5
1929	10,209	4,254	14,463	5.1	24,142	1,552	599	23.6	384	27.4	5,551	147	68.2
Chi., Burl. & Quincy....1930	44,544	16,659	61,203	5.2	26,064	1,837	799	25.1	554	35.3	3,657	118	58.8
1929	44,126	19,072	63,198	5.5	24,768	1,811	797	25.1	576	35.9	3,905	126	56.7
Chi., Rock I. & Pacific..1930	33,555	17,784	51,339	6.7	22,950	1,570	574	22.9	500	37.9	3,381	133	72.5
1929	29,121	18,913	48,034	7.2	19,986	1,448	543	22.3	551	40.6	3,496	140	76.6
Denver & R. G. Wn.....1930	13,165	2,933	16,098	3.9	21,887	1,687	754	26.3	319	17.8	2,004	158	36.8
1929	11,549	3,270	14,819	2.7	20,894	1,829	863	28.2	420	21.8	2,444	165	36.4
Oregon Short Line.....1930	8,247	4,041	12,288	4.6	26,696	1,746	720	24.2	501	30.8	2,424	107	51.5
1929	7,244	4,526	11,770	5.0	26,076	1,802	771	25.2	627	36.7	2,906	114	58.1
So. Pacific—Pacific Lines.1930	39,506	26,040	65,546	5.9	27,171	1,971	694	22.1	496	37.0	3,626	118	64.2
1929	38,098	30,586	68,684	5.4	25,676	1,940	729	23.1	538	36.9	4,233	119	68.4
Union Pacific 1930	22,920	8,471	31,391	9.5	42,055	2,224	848	20.5	752	52.1	6,268	102	65.8
1929	20,274	8,827	29,101	10.6	36,830	2,123	816	20.9	841	58.5	6,498	110	73.5
Southwestern Region:													
Gulf, Colo. & S. Fe....1930	10,610	3,410	14,020	3.7	30,124	2,046	899	27.2	505	28.1	3,664	95	69.8
1929	9,824	3,698	13,522	4.7	27,412	1,892	814	25.4	493	28.8	3,446	98	67.3
Mo.-Kans.-Texas Lines...1930	17,052	5,678	22,730	6.3	29,155	1,925	725	23.0	398	29.7	2,849	91	53.5
1929	15,827	7,043	22,870	6.9	28,745	2,024	749	22.1	470	36.4	3,387	95	60.1
Missouri Pacific 1930	29,321	19,098	48,419	5.8	27,113	1,848	729	24.3	688	45.6	4,486	117	79.6
1929	27,613	22,899	50,512	5.1	25,104	1,773	706	23.8	652	43.3	4,428	121	82.5
St. Louis-San Francisco..1930	24,117	8,048	32,165	3.3	21,325	1,544	598	23.6	469	33.3	2,887	141	60.8
1929	24,203	9,425	33,628	3.4	19,923	1,426	563	23.5	467	32.4	3,011	144	61.9
Texas & New Orleans...1930	11,583	13,381	24,964	4.2	21,173	1,421	521	22.5	484	35.2	2,568	92	69.5
1929	10,825	15,666	26,491	4.9	19,877	1,326	500	22.7	545	38.5	3,067	97	84.0
Texas & Pacific.....1930	5,948	5,645	11,593	6.1	26,740	1,825	652	23.8	828	62.1	4,921	87	64.2
1929	5,671	8,990	14,661	4.7	23,793	1,761	650	24.3	742	54.3	5,398	93	80.1

Traffic News

(*Continued from page 1607*)

court at Helena, Mont., on June 5, the complaint of the Northern Pacific and several other railroads being dismissed. Lower rates on petroleum and its products were ordered by the Montana commission in 1929 and the railroads obtained a temporary injunction. The case has twice been before the United States Supreme Court, which finally sent it back to the district court. The present decision was based on a recent decision of the Supreme Court in the case of a complaint made by the Great Northern against the North Dakota commission in which it was held that until the Interstate Commerce Commission makes a ruling on the rates the courts have no authority to act.

Canadian Newsprint Rate Case Adjourned

Because the time necessary to complete the case was not available at present, the Board of Railway Commissioners last Friday at Ottawa adjourned until October 6 the hearing on increased freight rates for Canadian newsprint destined to United States points. The case has been in progress for a week and will take at least two weeks additional to complete.

The hearing was considered one of the most important references to the Board for some time. About a year ago both the Canadian National and the Canadian Pacific announced the intention of increasing freight rates on newsprint consigned to United States on an average of 30 per cent. Immediate opposition was manifested from the newsprint manufacturers, and the Board ordered the proposed rates suspended until a formal hearing on their fairness and reasonableness could be held. The hearing which has been adjourned will settle the fate of the proposed rates.

The evidence presented so far in the case has largely been that of rate and traffic experts who have compared the existing rates, the proposed rates and comparative rates in the United States. It has been contended by the railroads that the present rates do not permit the newsprint traffic to be carried at a profit, and that other traffic must shoulder the attendant loss. The newsprint manufacturers have argued that the present rates are too high and, therefore, should not be increased. If the increased rates were placed in effect, Canadian newsprint mills would be in unfair competition with American mills in that market, it was argued.

Trans-Missouri-Kansas Shippers' Board

A decrease in business of 2.9 per cent during July, August and September as compared with the same months of 1929 in Missouri, Kansas and parts of Oklahoma, Arkansas and Illinois was forecast by the Trans-Missouri-Kansas Shippers' Advisory Board, at Salina, Kan., on June 18. The grain committee estimated that the wheat production in Kansas this year will be 131,427,000 bu., an average of 11.2 bu. per acre, contrasted with government estimates of 137,300,000 bu. Box car requirements for grain movement will total 107,000 in the third quarter, an increase of 0.3 per cent over actual shipments a year ago.

Commodities whose car needs represent a probable increase in the third quarter are: Cement, sand and gravel, 6.4 per cent; petroleum and products, 3 per cent; hay, straw and alfalfa, 15 per cent. Those anticipating decreases in car requirements, are: Agricultural implements, 5 per cent; automobiles, 31.5 per cent; clay products, 28.2 per cent; coke, 12.2 per cent; dairy products, 5.6 per cent; fresh fruits, 15 per cent; fresh vegetables, 20 per cent; iron and steel, 7.6 per cent; boilers and machinery, 30.7 per cent; lime, plaster and gypsum, 4 per cent; livestock, 1.9 per cent; lumber, 25 per cent; forest products, 25 per cent; ore, 31.6 per cent; other metals, 15.1 per cent; packing house products, 12.8 per cent.

Railroad representatives reported that as of May 31, over 27,000 cars were stored to protect grain loading during the harvesting season. This was an increase of 14 per cent over 1928, when Kansas produced her second largest yield, and the largest yield since the advent of the combine harvester. It is expected that favorable weather and an increased number of combines will operate to accelerate the harvest this year.

Re-Opening of California Deciduous Fruit Case Asked

The California Growers' and Shippers' Protective League has filed with the Interstate Commerce Commission a petition for a re-opening for rehearing and reargument of the case in which the commission ordered a reduction in rates on deciduous fruits from California under the Hoch-Smith resolution, which led to the decision of the Supreme Court that the commission had misinterpreted the resolution. The league also filed a motion for leave to file an amended complaint asking a reduction in the rates under the provisions of sections 1 and 3 of the interstate commerce act without reference to the Hoch-Smith resolution, but seeking a rate lower even than that ordered by the commission. The amended complaint asserts that the rate of $1.73 from California to eastern destinations which the commission held to be not unreasonable in 1925 but ordered reduced to $1.62 in 1927 is unreasonable and discriminatory and that it ought not to exceed $1.44. It is asserted that the railroads have reduced other rates from California and that the complainants' products are bearing a disproportionate burden. The court said that the resolution did not require rates any lower than would be required by other provisions of the law.

The railroads on June 19, filed sixth section applications with the commission for authority to restore on 15 days' notice the $1.73 rate which was in effect prior to February 10, 1928, when the reduced rate ordered by the commission went into effect.

Equipment and Supplies

Freight Cars

THE NORFOLK & WESTERN will build 500 all-steel box cars at its Roanoke, Va., shops.

THE BETHLEHEM STEEL COMPANY is inquiring for trucks for five ore cars of 50 tons' capacity.

THE PORTLAND CEMENT COMPANY, Mexico, D. F., Mexico, is inquiring for 20 side-door gondola cars of 50 tons' capacity.

Signaling

THE PENNSYLVANIA has ordered from the Union Switch & Signal Company an electro-pneumatic interlocking, 27 levers, for Hackensack River drawbridge, (Marion, N. J.).

THE CHICAGO & NORTH WESTERN has ordered from the General Railway Signal Company material for an extensive addition to the electric interlocking at Clinton street, Chicago.

THE ANN ARBOR has ordered from the Union Switch & Signal Company material for the installation of automatic block signaling on its line between Ann Arbor Mich., and Milan, 14 miles, single track. Color-light signals will be used.

THE MISSOURI-KANSAS-TEXAS has ordered from the Union Switch & Signal Company materials for remote operation of switches and signals at Vinita, Okla., Cobell, Tex., and Nevada, Mo. The order includes three interlocking machines and other material.

THE TEXAS & PACIFIC has ordered from the General Railway Signal Company material for extending the limits of the centralized traffic control system which centers at Arlington, Tex.; and with this addition, which extends from Dallas to Nussbaumer, 10 miles, the centralized system will cover all train movements between Dallas and Fort Worth, 32 miles.

THE NORTHERN PACIFIC is running an 18-car educational train known as the Low-Cost Farming Special, through eastern and central Montana, having started it on June 23. Eighteen stops will be made during a period of 10 days at farming centers on the Northern Pacific in Montana. The train, which is being operated in conjunction with the Montana State College and various local communities, will consist of four coaches filled with crop exhibits and 14 flat cars loaded with modern machinery to demonstrate the most economical use of various tillage and harvest implements.

Supply Trade

The Ash Grove Line & Portland Cement Company, Kansas City, Mo., has moved its general offices in that city to the Fairfax building, 101 West Eleventh Street.

The Ohio Brass Company, Mansfield, Ohio, has moved its Philadelphia, Pa., offices from the Packard building to Room 1164, Broad Street Station Building, 1617 Pennsylvania boulevard. The telephone numbers remain the same as in the former offices.

The American Tar Products Company, Pittsburgh, Pa., has acquired the **Ayer & Lord Tie Company,** Chicago. All of the officers of the Ayer & Lord Company will continue in their present capacities and the company will be operated as a separate unit of the controlling company. The Ayer & Lord Company operates timber treating plants at Carbondale, Ill., Louisville, Ky., North Little Rock, Ark., Grenada, Miss., and Montgomery, Ala., a tie storage plant at Brookport, Ill., marine ways at Paducah, Ky., and a creosote oil station at New Orleans, La.

Bullard-Davis, Inc., a subsidiary of the **Davis Emergency Equipment Company,** New York, manufacturers and distributors of first aid and safety equipment, has formed a wholly-owned subsidiary, the **Davis Emergency Equipment Company, Ltd.** The newly organized company will be the exclusive sales representative for Davis products in 11 western states. Its offices, to be located at 1268 Mission **street, San Francisco,** Cal., will be under the management of **Herbert Brendlen,** formerly New Jersey sales representative of Bullard-Davis, Inc. Other changes in the Bullard-Davis sales organization include the appointments of **L. S. Johnston** as sales representative in the Boston, Mass., territory; of **Daryl Potter** as a member of the San Francisco sales force; of **H. C. Weigley** and **J. B. Blakemore** as manager and assistant manager, respectively, of the Houston, Tex., sales office; of **H. J. Elwood** as sales representative in northern and western New York state, with headquarters at Buffalo, N. Y., and of **L. W. Brendlen** as sales representative in the New Jersey territory.

American Car & Foundry Company

The thirty-first annual report of the American Car & Foundry Company, issued on June 26, for the fiscal year ending April 30, 1930, shows net earnings for the year of $5,363,765. This amount, which compares with a 1928-1929 net of $2,715,174, was equivalent to the full dividend of $7 per share on 300,000 shares of preferred stock and to slightly over $5.40 per share on 600,000 shares of no-par common stock. Additional funds, amounting to $336,235, necessary to pay the full common dividend, were appropriated from a special reserve maintained for that purpose.

In his remarks to the stockholders, President W. H. Woodin speaks in part as follows:

As noted in the last annual report, your Company at the beginning of the fiscal year just ended, had equipment orders on its books in number appreciably in excess of that which it had at the corresponding period of the preceding year. There followed a period during which the railroads did but little purchasing, but later in the year there was a resumption of buying in fair volume—and the management is glad to report that your Company entered upon the fiscal year now current with a comfortable amount of business on its books.

There has been no relaxation of effort to increase and extend the operations of your Company in the manufacture and sale of miscellaneous products of widely diversified kinds. Such is now a very important branch of the Company's activities. Both in volume and in profits, the results of this miscellaneous business for the year just ended were in excess of those for the preceding year.

The year just closed has witnessed one of the greatest stock market debacles of recent times—the logical and inevitable ending of a protracted period of speculation resulting in an unwarranted inflation of security prices. Unfortunately the crash was not limited to those securities which, by mere speculation, had been put to a price-level not justified either by inherent soundness or by demonstrated earning capacity. All securities on the list, the sound as well as the unsound, have been affected in greater or less degree.

Recovery from such condition is bound to be a slow and painful process—one of alternate advance and recession until the country and its industries once more "find themselves." It is a trite, but nevertheless a true, thing to say that the industrial condition of the country is basically sound. Living costs and commodity prices are steadily lessening; money is plentiful and cheap; while there has been perhaps too great an increase in the facilities for production in certain lines, there is no evidence of over-production to any considerable extent; we are assured by competent authority that the figures of unemployment are decreasing; the new tariff law has finally been enacted and commerce and industry thereby freed of the uncertainty always a concomitant of tariff revision. The country and its industries have lived through periods of depression much more severe than that of the present, and there is no reason to believe that we shall not again, and within a reasonably short time, get our soundings and attain a condition of stable equilibrium.

The management cannot control the market quotations of your Company's stock. It can, however, point to the soundness of the Company's condition as shown by the balance sheet, and to the record of its earnings and dividend disbursements during the thirty-one years of its existence, to justify confidence in the inherent value of its securities, both preferred and common.

There is recorded, with deep sorrow, the death on October 9, of Mr. Dallas Bache Pratt, who had served as a member of the Board of Directors of your Company from January 6, 1927, until the date of his death.

The Management once again makes of record its thanks and appreciation to the members of the Company's organization for their loyal and efficient cooperation and help in the handling of the Company's business and affairs during the year just ended.

STATEMENT OF CONSOLIDATED NET EARNINGS

Earnings from all sources for the thirty-first fiscal year ended April 30, 1930—before deducting Repairs, Renewals, etc., as noted hereunder —and after making provision for Federal Taxes ($556,080).....	$8,704,093
Less: Renewals, Replacements, Repairs, New Patterns, Flasks, etc...	3,340,328
Net Earnings	$5,363,765

STATEMENT OF CONSOLIDATED SURPLUS

Consolidated Surplus, April 30, 1929		$40,138,673
Add: Net Earnings for the year....		5,363,765
		45,502,438
Less: Dividends On Preferred Capital Stock, 7%	$2,100,000	
On Common Capital Stock	3,600,000	
	5,700,000	
Less: Common Stock Dividends paid from Reserve applicable for that purpose	336,235	5,363,765
Consolidated Surplus, April 30, 1930.		$40,138,673

Construction

CANADIAN NATIONAL. — This company and the City of Regina, Sask., have reached an agreement for the construction of a new freight line on the outskirts of Regina, which will involve a total expenditure of about $500,000. The project involves the construction of a highway subway under the new line at Winnipeg street.

CHESAPEAKE & OHIO.—A contract has been awarded to the Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., for the construction of a water-treating station at Seth, W. Va.

ERIE-LEHIGH VALLEY.—By order of the Public Service Commission of New York, the bridges carrying the tracks of these two companies over the Waverly-Oswego highway in Tioga, N. Y., will be reconstructed, in connection with a general plan of highway relocation, to increase visibility at the underpasses. The cost to the railroads is estimated at approximately $64,000.

LOUISVILLE & NASHVILLE.—The general contract for the construction of a power plant at Howell, Ind., has been awarded to Platoff & Bush, Louisville, Ky., at a cost of about $35,000.

NEW YORK CENTRAL.—The Public Service Commission has approved the low bid of $66,474 submitted by William J. Gallagher, Medina, N. Y., for the reconstruction of the bridge carrying the Medina-Albion state highway over this company's tracks in Ridgway, N. Y. The railroad has been directed to award the contract.

OREGON-WASHINGTON. — The Interstate Commerce Commission has postponed from July 1 to January 1, 1931, the effective date of its order of December 3, 1929, in which it required this company to build an extension across the state of Oregon from Crane to Crescent Lake, about 185 miles. The postponement was granted at the request of the federal court for the district of Oregon in which the company has brought suit to set aside the commission's order.

PERE MARQUETTE.—A contract for the construction of the substructure for two fixed spans and one movable span for a steel bridge at Port Huron, Mich., has been awarded to the Jutton Kelly Company, Detroit, Mich. A contract for the fabrication and erection of the superstructure has been let to the American Bridge Company, New York. The bridge will have a total length of 261 ft. and will involve an expenditure of about $500,000.

UNION PACIFIC.—A contract has been let to Ryberg Brothers, Salt Lake City, Utah, and the Morrison Knudson Company, Boise, Idaho, for the construction of a concrete-lined water reservoir at Hanna, Wyo.

Railway Finance

ARANSAS HARBOR TERMINAL.—*Purchase by New Interests.*—The properties of this company and the Aransas Dock & Channel Company at Aransas Pass, Tex., have been acquired from Alexander Brown of Baltimore, Md., by a group of capitalists headed by Gail Borden Munsil of Winsted, Conn. It is planned to expend about $10,000,000 in the construction of improvements.

BOSTON & MAINE.—*Stock.*—The Interstate Commerce Commission has authorized this company to issue $7,500,000 of its 7 per cent prior-preference stock, par value $100, to be exchanged on equal terms for its mortgage bonds. The amount of bonds convertible per annum during the years 1930-33, is limited to the amount of the stock now authorized to be issued, which covers the requirements for the year 1931.

CHESAPEAKE & OHIO.—*Acquisition.*—This company has applied to the Interstate Commerce Commission for authority to acquire the property of the Wellston & Jackson Belt, 17.26 miles and the Pomeroy Belt, 3.95 miles, the stock of which was owned by the Hocking Valley and which have been operated by the Hocking Valley. The acquisition is part of the transaction by which the C. & O. recently acquired complete control of the Hocking Valley.

Abandonment.—The C. & O. has applied to the commission for authority to abandon its Kentucky & South Atlantic subdivision, from Mt. Sterling to Rockwell, Ky., 19.5 miles. The application says the operation of the line has resulted in a loss of $185,732 in the last five years.

CHESAPEAKE BEACH.—*Ferry Service.*—Examiner R. R. Molster of the Interstate Commerce Commission has recommended in a proposed report that the commission grant this company's application for authority to establish a ferry service across Chesapeake Bay between Chesapeake Beach and a point on Trippe's Bay, near Hudson, Md.

CHICAGO & ALTON.—*Stockholders' Petition Denied.*—A petition filed by the Alton Corporation of Detroit, Mich., and Charles Clay Briggs of Mississippi, on behalf of certain stockholders of this railroad, seeking to intervene in the receivership proceedings, was denied by Federal Judge George A. Carpenter at Chicago on June 23. The petition sought to void as illegal the reorganization of the company in 1906, two mortgages which underlie bond issues of the Alton, and the receivership of the company instituted in 1922.

It was alleged among other things that E. H. Harriman, Mortimer L. Schiff and several associates controlled the road after the reorganization of 1906, and gained enormous illegal profits through the sale of its securities, and that they or their heirs still hold a large amount of the bonds on which back interest was allowed in the decree of foreclosure and sale of the Alton, handed down by Judge Carpenter some time ago and recently sustained by the federal circuit court of appeals.

The petition asked also that the receivers be discharged and that the stockholders be given "the benefit of the intrinsic value of the property of said railroad." The time that had elapsed between the beginning of the receivership and the filing of the petition was one of the reasons advanced by Judge Carpenter for denying the petition.

CHICAGO & NORTH WESTERN.—*Equipment Trust.*—The Interstate Commerce Commission has authorized this company to assume obligation and liability for $1,425,000 of its series X 4½ per cent equipment trust of 1929 certificates, maturing in installments from 1931 to 1945, the issue being authorized for sale at 99.68 to the First National Bank and Salomon Brothers & Hutzler which will make the average annual cost to the railroad approximately 4.55 per cent.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—*Bonds.*—The Interstate Commerce Commission has authorized this company to issue $1,000,000 of its first and general mortgage 5 per cent, series A, bonds, to be sold to Potter & Co., and Harris Forbes & Co., at 101.75, making the average annual cost to the railroad approximately 4.9 per cent.

CHICAGO, ROCK ISLAND & PACIFIC.—*New Director.*—Charles S. McCain, chairman of the board of the Chase National Bank, New York, has been elected a member of the board of directors of this company.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.—*Equipment Trust.*—The Interstate Commerce Commission has authorized this company to assume obligation and liability for $390,000 of its series H 4¾ per cent equipment trust certificates of 1928, maturing in installments from 1930 to 1944, the issue being authorized for sale to the Harris Trust & Savings Bank and the First-Union Trust & Savings Bank (both of Chicago) at 100.277, making the average annual cost to the railroad approximately 4.70 per cent.

COLORADO & SOUTHERN.—*Bonds.*—J. P. Morgan & Co., the National City Company and the First National Bank are offering, subject to authorization by the Interstate Commerce Commission, $20,000,000 of general mortgage 4½ per cent series A bonds of this company, maturing in 1980, at 95¼, to yield approximately 4.75 per cent.

LEAVENWORTH & TOPEKA.—*Abandonment.*—This company has applied to the Interstate Commerce Commission for authority to abandon its line from Leavenworth to Meriden Junction, Kan., 47 miles, and to abandon the operation of the line from Ozaukie to Leavenworth, 37 miles. The application says the people of Leavenworth county are unwilling to vote further aid to meet the operating deficits as they have done for many years past.

LOUISIANA, ARKANSAS & TEXAS.—*Trackage Rights.*—The Interstate Commerce Commission has authorized this company to operate under trackage rights over the St. Louis Southwestern of Texas, between Greenville, Tex., and Dallas, 61.1 miles.

LOUISVILLE & NASHVILLE.—*Acquisition.*—This company has applied to the Interstate Commerce Commission for authority to acquire and operate the Carrollton Railroad, which has also applied to the commission for authority to acquire the property of the Carrollton & Worthville, which has a line from Carrollton to Worthville, Ky., 10 miles. The new company has asked authority to issue $75,000 in stock and $25,000 in bonds or notes for the purpose. The Louisville & Nashville has also applied to the commission for authority to acquire part of the line of the Pontchartrain Railroad, 1.36 miles, in New Orleans, La., and the Pontchartrain has applied to the Commission for authority to abandon the remainder of its line, 4.56 miles.

NEW YORK CENTRAL.—*Abandonment.*—The Interstate Commerce Commission has authorized the abandonment of the Sunday Creek R. R. extending from Sayre, Ohio, to San Toy, 4.3 miles.

PERE MARQUETTE.—*Trackage Rights.*—The Interstate Commerce Commission has authorized this company to operate under trackage rights over the Erie from Suspension Bridge, N. Y., to East Buffalo, 23.2 miles. The Pere Marquette has heretofore operated from St. Thomas, Ont., to Black Rock, N. Y., and Suspension Bridge through intermediate switching arrangements into Buffalo. Under the present arrangement it will operate its own freight trains via Suspension Bridge into the East Buffalo yards of the Erie.

PITTSBURGH & LAKE ERIE.—*Annual Report.*—The 1929 annual report of this company shows net income after interest and other charges of $7,555,335, as compared with net income in 1928 of $7,171,890. Selected items from the income statement follow:

	1929	1928	Increase or decrease
Average mileage operated	231.27	231.27	.....
RAILWAY OPERATING REVENUES	34,135,108	31,406,816	+2,728,292
Maintenance of way	4,063,519	4,235,852	— 172,332
Maintenance of equipment	11,924,609	9,903,424	+2,021,184
Transportation	10,978,383	10,137,409	+ 840,974
TOTAL OPERATING EXPENSES	28,396,025	25,602,990	+2,793,036
Operating ratio	83.19	81.52	+ 1.67
NET REVENUE FROM OPERATIONS	5,739,083	5,803,826	— 64,743

	1929	1928	Increase or decrease
Railway tax accruals	2,117,333	2,038,877	+ 78,456
Railway operating income ..	3,621,584	3,763,044	— 141,459
Equipment rents —Net Cr. ...	4,332,974	4,061,015	+ 271,959
Joint facility rents—Net Dr.	63,018	53,230	+ 9,788
NET RAILWAY OPERATING INCOME	7,891,540	7,770,829	+ 120,712
Non-operating income	1,467,331	1,120,268	+ 347,064
GROSS INCOME..	9,358,872	8,891,097	+ 467,775
Rent for leased roads	620,559	622,943	— 2,384
Interest on funded debt..	151,312	171,127	— 19,815
TOTAL DEDUCTIONS FROM GROSS INCOME.	1,803,537	1,719,206	+ 84,331
NET INCOME...	7,555,335	7,171,890	+ 383,445

ST. LOUIS SOUTHWESTERN. — *Bonds.* — This company has applied to the Interstate Commerce Commission for authority to pledge or repledge as collateral for short term notes $10,108,000 of first terminal and unifying mortgage bonds held in its treasury.

SOUTHERN PACIFIC. — *Abandonment.* — Examiner M. S. Jameson of the Interstate Commerce Commission has recommended in a proposed report that the commission authorize the abandonment of the line of the New Mexico & Arizona from Flux to Calabasas, Ariz., 12.45 miles.

SOUTHERN PACIFIC.—*Trackage Rights.*— The Interstate Commerce Commission has authorized the Texas & New Orleans and the San Antonio & Aransas Pass to operate under trackage rights over six miles of terminal tracks of the Texas-Mexican; and has authorized the last named company to operate over four miles of terminal tracks of the S. A. & A. P.—all in the switching limits of Corpus Christi, Tex.

Dividends Declared

Albany & Susquehanna.—4½ per cent, payable July 1 to holders of record June 14.

Allegheny & Western.—3 per cent, payable July 1 to holders of record June 20.

Baltimore & Ohio.—Common, 1¼ per cent, quarterly; Preferred, 1 per cent, quarterly, both payable September 2 to holders of record July 19.

Kansas City Southern.—Common, 1¼ per cent, quarterly, payable August 1 to holders of record June 30; Preferred, 1 per cent, quarterly, payable July 15 to holders of record June 30.

Average Prices of Stocks and of Bonds

	June 24	Last week	Last year
Average price of 20 representative railway stocks.	110.33	116.41	140.96
Average price of 20 representative railway bonds..	93.89	94.04	89.88

THE READING ON JUNE 18 opened its new station at West Trenton (formerly Trenton Jct.) N. J. Co-incident with the opening, a motor coach service, provided by a local operator, was begun, providing easy access to the station from the business center of the city. Residents of Trenton desirous of utilizing the Reading's service formerly made connections with main line trains at Trenton Jct. by a rail motor car service operating on a branch line from the station in the city to Trenton Jct.

Railway Officers

Executive Changes on New Haven and N. Y., W. & B.

Leverett S. Miller, president of the New York, Westchester & Boston, a subsidiary of the New York, New Haven & Hartford, and of the highway subsidiaries of the former company, will retire at his own request on July 1, and will be succeeded by **J. J. Pelley,** president of the New Haven, who will assume the duties of the new office in addition to his position as president of the New Haven. (A sketch and photograph of Mr. Pelley appeared in the *Railway Age* of February 23, 1929, page 461.) Other changes in personnel effective July 1 are as follows: **P. W. J. Smith,** general superintendent of the New York, Westchester & Boston at Mount Vernon, N. Y., has been appointed president of the New England Transportation Company, highway subsidiary of the New York, New Haven & Hartford, succeeding **Arthur P. Russell,** who will continue as executive vice-president of the New Haven with headquarters at Boston. Mr. Smith will also

Leverett S. Miller

succeed Mr. Miller as president of the County Transportation Company and of the Soundview Transportation Company, highway subsidiaries of the N. Y., W. & B. **W. H. Foster,** general superintendent of the New York division of the New Haven, will assume additional duties as general superintendent of the Westchester line. **H. E. Baily,** superintendent of the New Haven, will also serve as superintendent of the New York, Westchester & Boston. While officers of the railroad were of the opinion that these changes in personnel would not result in any major changes in the operating system, they are expected to produce a more unified operation with resultant operating economies.

Mr. Miller was born on May 23, 1863, at New York, and was educated in private schools and at Rensselaer Polytechnic Institute of Troy, N. Y., receiving his C. E. degree from the latter in 1885. In that year he entered railroad service with the Denver, Utah & Pacific (now part of the Chicago, Burlington & Quincy), as engineer of maintenance, and in the intervening years has been engineer of the Colorado Railway; chief engineer of the Alabama Eastern; assistant resident-engineer of the Thames River bridge; assistant superintendent of the New York, Providence & Boston (now part of the N. Y., N. H. & H.); chief engineer and later assistant general manager of the St. Paul & Duluth (now part of the Northern Pacific); one of the receivers of the Washington Central; manager of the Seattle & International (also part of the Northern Pacific); assistant to president of the Erie; general manager of the Tennessee Central; general manager of the Tennessee Construction Company and general manager of the Central New England (now part of the N. Y., N. H. & H.), resigning from the latter position in May, 1909, to accept the presidency of the New York, Westchester & Boston. He became president of the County Transportation Company when it was formed in 1926.

Executive

Effective June 20, the office of the general manager of the Chesapeake Beach Railway at Washington, D. C., will be vacated by **Colonel Lee H. Landis,** resigned to accept appointment as co-receiver of the Wichita Northwestern. All matters formerly handled by Colonel Landis will temporarily be referred to **Eugene Fox,** executive vice-president.

H. E. McGee, vice-president and general manager of the Missouri-Kansas-Texas Lines, with headquarters at Dallas, Tex., has been elected executive vice-president, with headquarters at St. Louis, Mo., effective July 1. **F. W. Grace,** general superintendent of the Katy Lines with headquarters at Denison, Tex., has been promoted to general manager, with headquarters at Dallas.

Financial, Legal and Accounting

Augustus S. May, treasurer of the New York, New Haven & Hartford at New Haven, Conn., will retire July 1, after more than 57 years of service with that road, and will be succeeded by **T. F. Paradise,** assistant treasurer.

George B. Perkins, who has been promoted to assistant comptroller of the St. Louis-San Francisco, with headquarters at St. Louis, Mo., was born at Cincinnati, Ohio. After attending high school he entered railway service in July, 1901, as a clerk in the freight

accounting department of the Kansas City, Fort Scott & Memphis (now part of the Frisco). Later he was transferred to the general accounts department. During 1911 and part of 1912 he was out of railroad service, but while in the Pacific Northwest he became connected with the accounting department of the Spokane, Portland & Seattle in July, 1912. From January, 1914, to April, 1918, he acted as an examiner for the bureau of accounts of the Interstate Commerce Commission, then returning to railway service as general accountant of the Frisco at St. Louis. In July, 1918, Mr. Perkins was appointed assistant auditor, a year later he became assistant federal auditor, and on March 1, 1920, he became assistant general auditor. He was appointed assistant to the comptroller in 1922, auditor in 1923 and general auditor in July, 1929. His further promotion to assistant comptroller became effective in May.

Operating

The headquarters of **O. W. Page,** superintendent of the Kansas City division of the Atchison, Topeka & Santa Fe, and **I. Anderson,** division engineer of the same division, were removed from Kansas City, Mo., to Kansas City (Argentine), Kan., on June 23.

J. S. Bassett, assistant superintendent of the Arkansas division of the Missouri Pacific, at Little Rock, Ark., has been appointed acting superintendent of that division at the same point, succeeding **W. E. Lamb,** who was granted a leave of absence on June 15.

Traffic

L. C. Bostwick has been appointed general agent for the Ann Arbor at New York, succeeding **L. J. Goetz,** deceased.

W. D. Burch, general agent for the Louisiana & Arkansas Lines at Tulsa, Okla., has been promoted to general freight agent with headquarters at Shreveport, La. **Roy Wattenbarger,** commercial agent at Tulsa, has been promoted to general agent at the same point, succeeding Mr. Burch.

G. B. Wood, freight traffic manager of the Kansas City Southern, with headquarters at Kansas City, Mo., has been placed in charge of all matters pertaining to freight traffic on that road and the Arkansas Western, following the election of **H. A. Weaver** as vice-president in charge of traffic.

J. F. Pewters, assistant general freight and passenger agent on the Great Northern at Helena, Mont., has been appointed assistant general freight agent at St. Paul, Minn. **C. F. O'Hara,** general agent at Great Falls, Mont., has been promoted to assistant general freight and passenger agent at Helena, to succeed Mr. Pewters.

S. B. Murdock, assistant passenger traffic manager of the Seaboard Air Line, with headquarters at Norfolk, Va., has been transferred in a similar capacity to New York, and **George Z. Phillips** has been appointed to succeed him as assistant passenger traffic manager at Norfolk. **W. Hugh Donny** has been appointed general agent at Washington, D. C.

Engineering, Maintenance of Way and Signaling

P. L. Barker has been appointed division engineer of the St. Lawrence division of the New York Central, with headquarters at Watertown, N. Y.

Frank L. Wheaton, division engineer of the Buffalo division of the Delaware, Lackawanna & Western, with headquarters at Buffalo, N. Y., will retire on July 1. He has been connected with the engineering force of the Lackawanna more than 30 years.

L. G. Harris, construction engineer on the Coast lines of the Atchison, Topeka & Santa Fe, has been appointed district engineer of the Northern district, with headquarters at La Junta, Colo. Mr. Harris replaces **D. E. Helvern,** who has been appointed division engineer of the Colorado division at Pueblo, Colo., succeeding **O. F. Arthur,** who has been transferred to the Rio Grande division at Albuquerque, N. M.

Julius C. Mill, signal engineer of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Milwaukee, Wis., will retire from active duty on July 1, after more than 29 years of service with that road. Mr. Mill was born in Wisconsin on October 12, 1881, and obtained his electrical engineering education at Highland Park College, now Des Moines

Julius C. Mill

University. He entered railway service in 1901, as a draftsman on the Chicago Milwaukee, St. Paul & Pacific. In 1910 he was advanced to signal inspector, then being promoted to assistant signal engineer in 1912. Mr. Mill was promoted to signal engineer of the Milwaukee in August, 1913.

Special

K. D. Pulcipher, editor of the western region edition of the Pennsylvania News at Chicago, has been promoted to manager of the publicity department of the Pennsylvania with headquarters at Philadelphia, Pa. **Ray D. Casey,** special publicity representative at Philadelphia has been appointed editor of the Pennsylvania News, western region edition, succeeding Mr. Pulcipher.

Obituary

T. F. Whittelsey, secretary-treasurer of the American Short Line Railroad Association, died on June 21, shortly after an operation.

L. J. Goetz, general agent for the Ann Arbor at New York, died at his home at River Edge, N. J., on June 2, at the age of 33 years.

John T. Pritchard, former assistant treasurer of the Central of New Jersey, died at his home in South Orange, N. J., on June 21, after a long illness. He was 75 years old.

Alexander A. Smith, ticket auditor of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn., since 1910, died at the Northwestern hospital in that city on June 21, after an illness of seven weeks.

Henry C. Snyder, assistant freight traffic manager of the Erie, with headquarters at New York, died, after an operation, at East Orange, N. J., on June 20, at the age of 62. Mr. Snyder was born in July 1868, at Delaware Water Gap, Pa., and was educated in the public schools and at Belvidere Seminary. He had passed 43 years in the service of the Erie, beginning as a telegraph operator in 1887. Mr. Snyder was appointed agent at Ramapo, N. Y., and later served as agent in Middletown, N. Y., Newark, N. J., and Paterson. In 1896, when the railroad created the office of a general agent at Newark in charge of the system's business there, he was assigned to that position. In 1903 he was appointed division freight agent at Bradford, Pa., and later held the same position at Youngstown, Ohio, and Buffalo, N. Y. In 1908 he became assistant general freight agent of the Erie at Chicago, where he remained until 1920 when he became general freight and passenger agent of the New York region. In 1923 he was appointed general freight agent and in 1927 he was advanced to assistant freight traffic manager, the position he held at the time of his death.

LOCOMOTIVE CRANES.—An attractive booklet of 15 pages, designated No. 309, has been issued by the Industrial Brownhoist Corporation, Cleveland, Ohio, which illustrates and describes in detail the complete line of gasoline- and Diesel-powered locomotive cranes manufactured by that company. This line of cranes includes machines with capacities ranging from 10 tons to 40 tons.

JUNE 28, 1930

Railway Age

Founded In 1856

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Buyers Directory of Advertisers—Page 141

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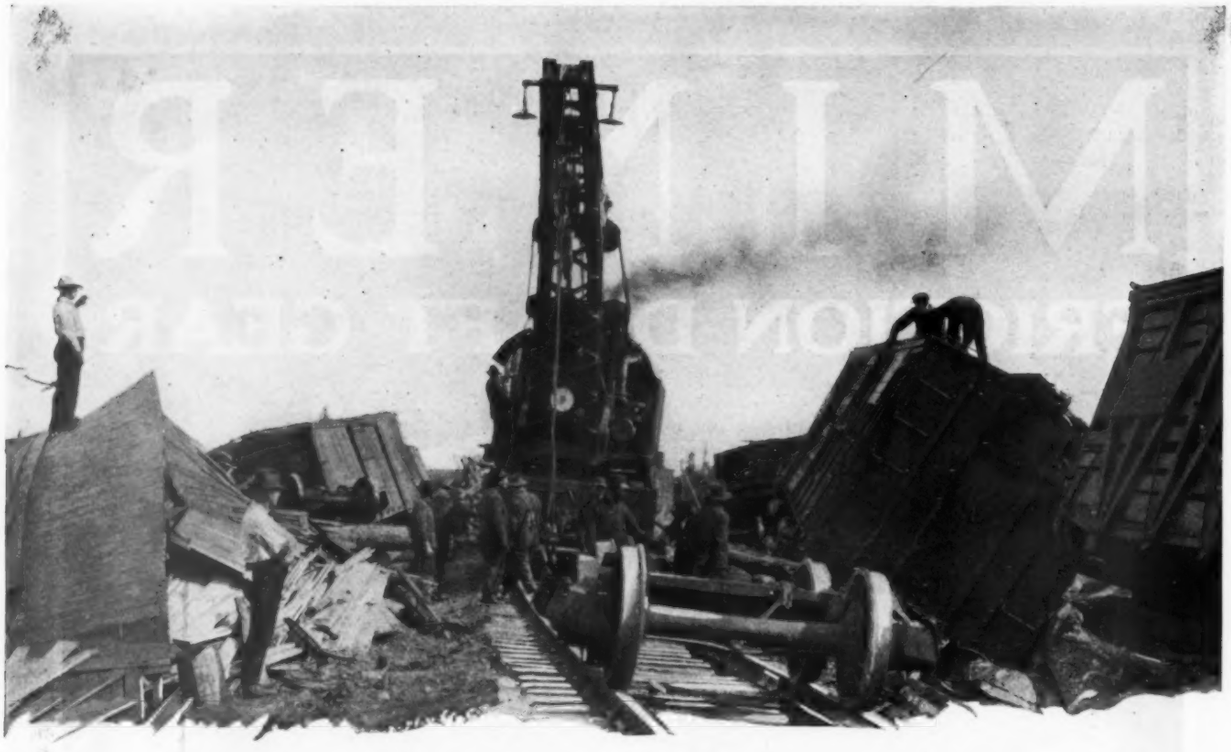


The Big Hook Is on the Job

Railroad transportation is one of the outstanding reasons for this country's prosperity because the roads have learned how to move materials quickly and at low cost. Traffic must be kept moving and when an occasional tie-up occurs, it is only a short time before a "Big Hook" appears on the scene and straightens things out.

The railroads long ago found locomotive cranes to be an indispensable part of their work equipment and thousands of these machines are used by them for every kind of bucket, hook and magnet service. Few owners have the opportunity to know cranes as the railroads do and it is a significant fact that they use far more Industrial Brownhoists than any other make.

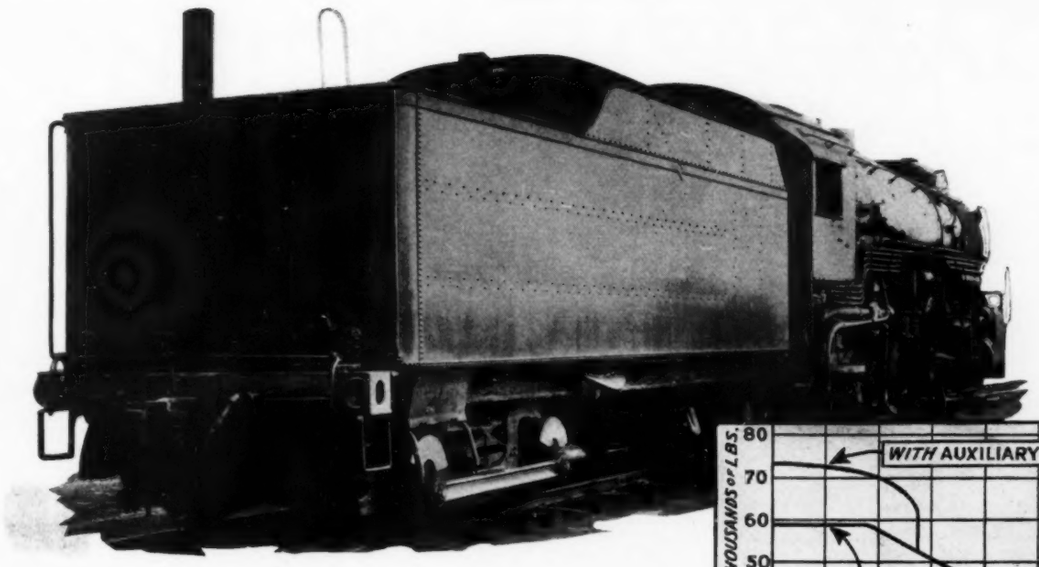
The leaders in practically every line of industry are using Industrial Brownhoists and will tell you that it is surprising how quickly one will pay for itself around the average plant or yard. Our factory trained representatives know the advantages of both crawler and eight-wheel locomotive cranes and can, without prejudice, recommend the right machine for your use because we build a complete line of each type.

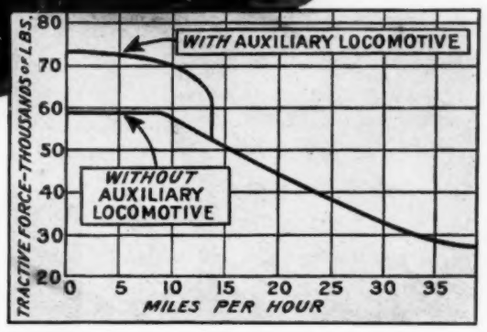
Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland.

Plants: Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST





The curve above shows the great reserve of tractive force that the Bethlehem Auxiliary Locomotive provides at low speeds, opening the way for more efficient operation at higher speeds.

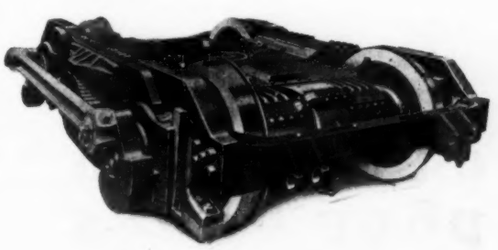
For higher efficiency of your motive power

Because a locomotive must have sufficient reserve tractive force to start a train and to get it over ruling grades, it is working most of the time at much less than full capacity—an uneconomical condition. In starting and at speeds under ten or twelve miles per hour, the locomotive boiler has ample steam generating capacity to supply larger cylinders than those provided. But it would be useless to have extra cylinder capacity on the locomotive, as the adhesion would not be sufficient to transmit the added power to the draw-bar.

The use of one or two Bethlehem Auxiliary Locomotives under the tender solves the problem of applying the full power of the boiler to the load, to start it or pull it over heavy grades. The Auxiliaries supply the cylinder capacity and the tender supplies the weight for the additional tractive effort, which amounts to from 10,000 to 18,000 pounds for each Auxiliary Locomotive.

With this reserve tractive effort for starting, for getting over ruling grades, and for emergencies, the locomotive can haul a train of such weight that it works at more nearly full capacity all of the time, with a consequent decided increase in efficiency.

The Bethlehem Auxiliary Locomotive is made in both four- and six-wheel types. It is readily installed in place of one or both of the tender trucks and can be cut in or cut out at will, thus providing an instantly available reserve of tractive force.



BETHLEHEM

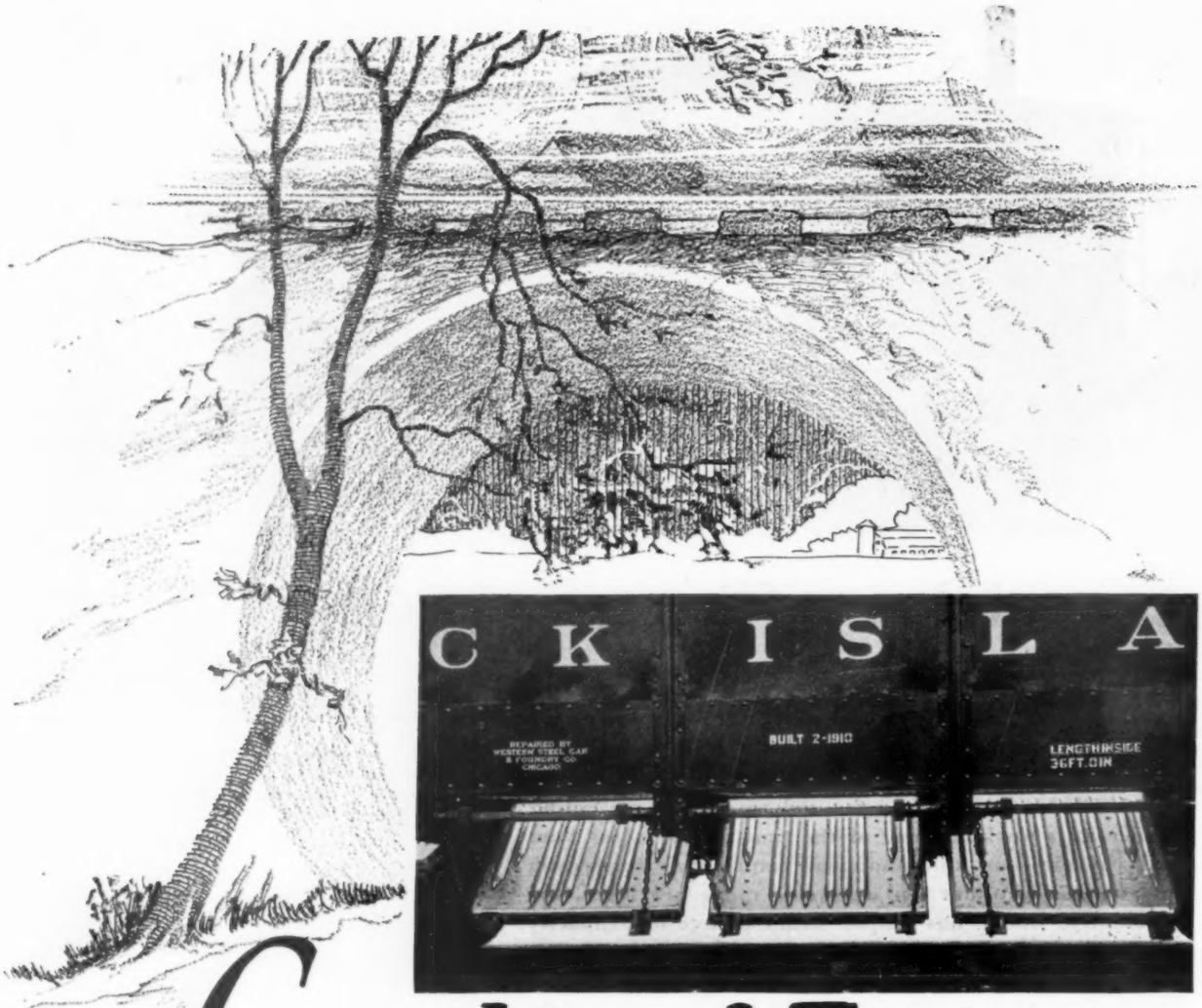
BETHLEHEM STEEL COMPANY, *General Offices:* Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Buffalo, Pittsburgh, Cleveland, Cincinnati, Detroit, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle, Portland, Honolulu.

Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

Auxiliary Locomotive



Combined Features

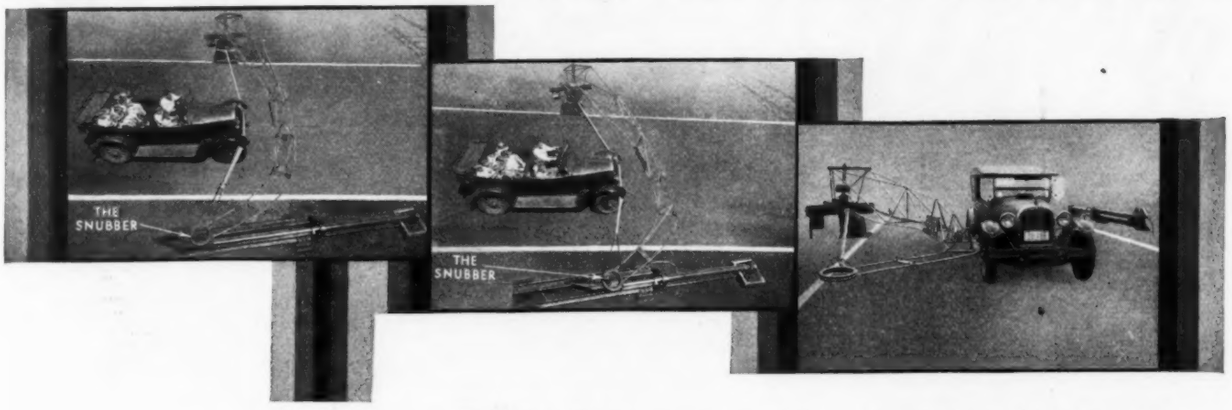
AJAX CORRUGATED DROP DOORS

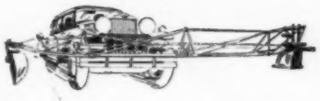
Resiliency and strength are twin attributes of Ajax Corrugated Doors. Hard blows are cushioned and permit the doors to return to their original shape without permanent set.

UNION METAL PRODUCTS COMPANY

NEW YORK · CHICAGO · PHILADELPHIA · ST. LOUIS · WASHINGTON
RICHMOND · HOUSTON · SAN FRANCISCO · KANSAS CITY · MONTREAL

CONSIDER THESE FACTS
BEFORE CHOOSING GRADE CROSSING PROTECTORS





The fundamental idea from which THE HIGHWAY GUARDIAN has been developed was the ingenious conception of Mr. Joseph B. Strauss, eminent consulting engineer and builder of many of the world's famous bridges.

ONE of the greatest problems facing the railroads today is grade crossing protection. Trains are faster, crossings more numerous and motor vehicles travel at speeds unthought of a few years ago.

To combat these conditions, THE HIGHWAY GUARDIAN offers more advantages than any other type of crossing protection.

It is a positive, automatically operated BARRIER.

Without damage to vehicles or injury to occupants motorists are forcibly STOPPED.

Installation does not change TRACKS or HIGHWAY.

Operation is as RELIABLE as a signal system.

Without delay, set-up can be made, affording PROTECTION AT ONCE.

By preventing accidents, LIVES ARE SAVED, wrecks prevented, damage claims eliminated.

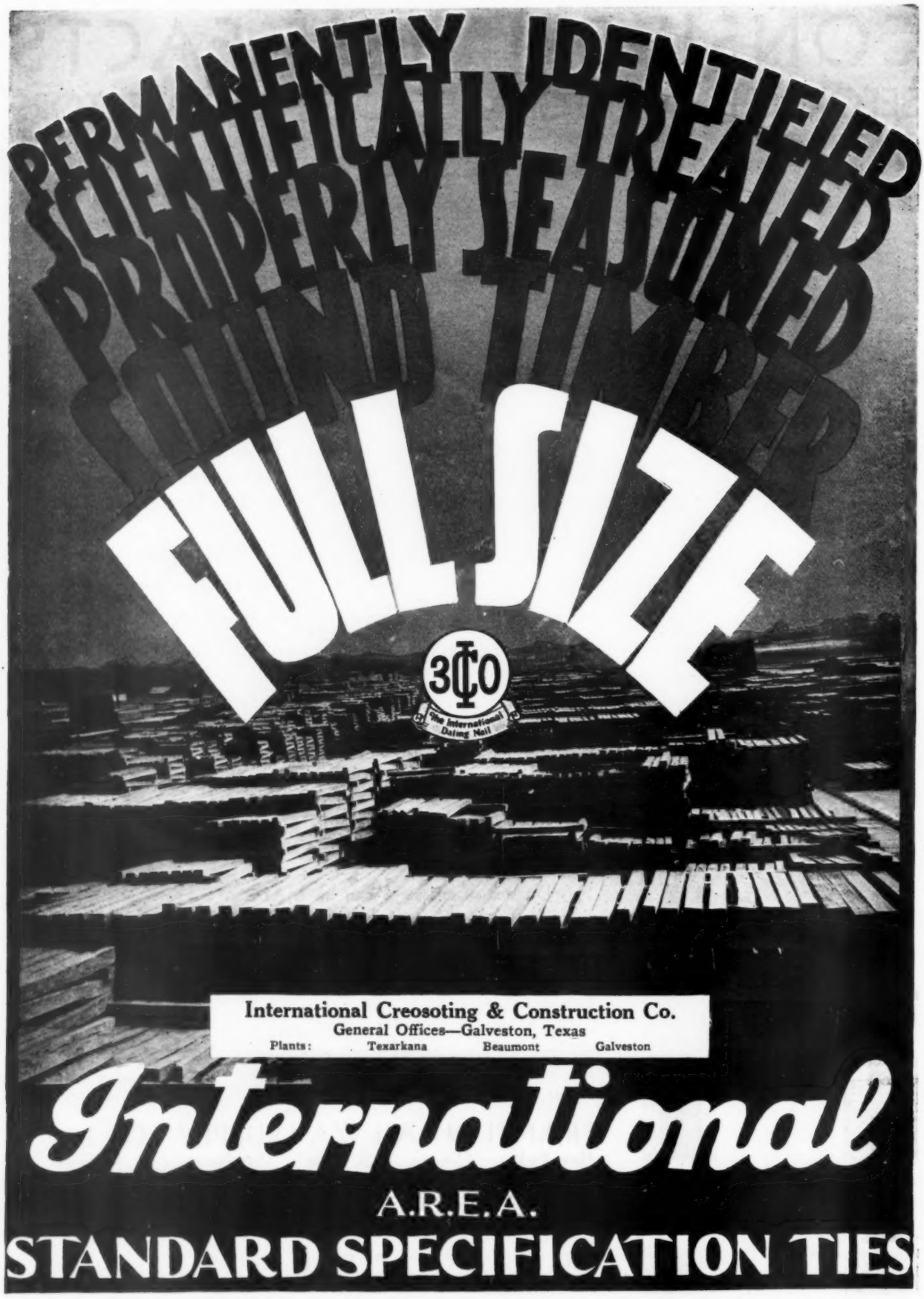
Dozens of crossings can be MADE SAFE for the cost of a few grade separations.

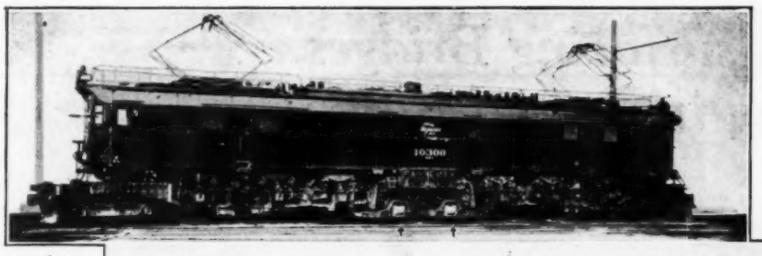
THE HIGHWAY GUARDIAN offers a means of protecting crossings that is as modern as the best cars on the highway or the fast expresses on the tracks. Consider the advantages it will give, the actual money it will save, when the important subject of crossing protection comes up for discussion.

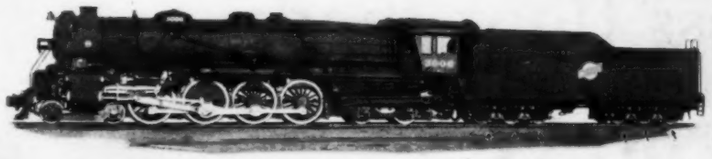
Bulletin No. 750 tells the interesting story of THE HIGHWAY GUARDIAN'S operation. Write for a copy.

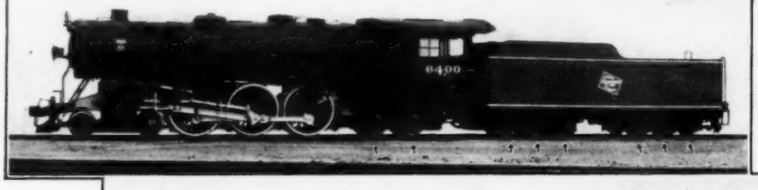
FRANKLIN RAILWAY SUPPLY CO., Inc.
New York Chicago St. Louis San Francisco Montreal

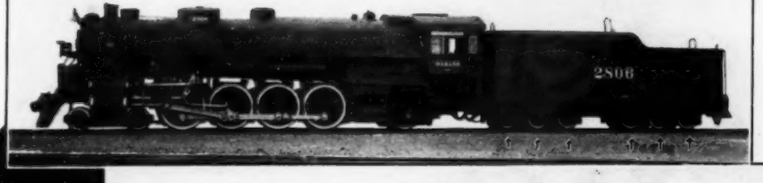
THE HIGHWAY GUARDIAN
THE CROSSING GATE THE MOTORIST CANNOT CRASH

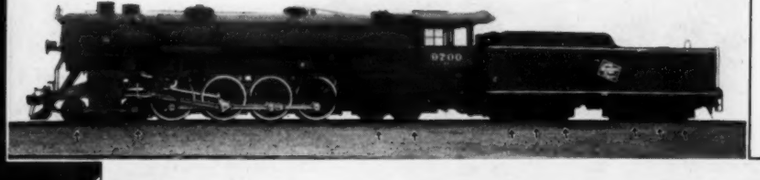

PERMANENTLY IDENTIFIED
SCIENTIFICALLY TREATED
PROPERLY SEASONED
SOUND TIMBER
FULL SIZE
3IC O
The International Dating Nail
International Creosoting & Construction Co.
General Offices—Galveston, Texas
Plants: Texarkana Beaumont Galveston
International
A.R.E.A.
STANDARD SPECIFICATION TIES

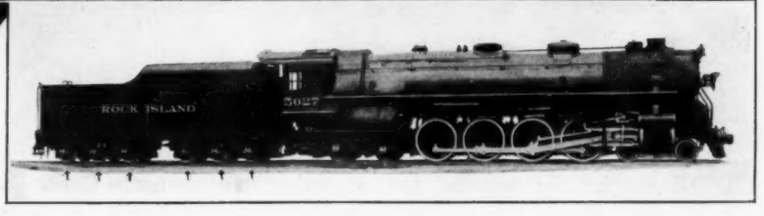


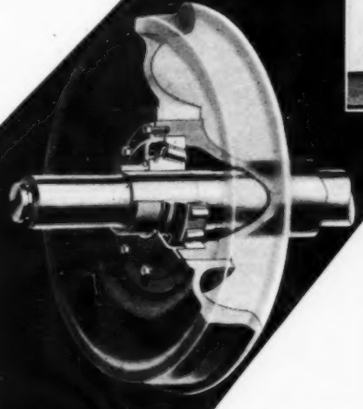












heavy loads

Roller Bearings mounted within the wheel hubs—the American Steel Foundries Roller Bearing Units—may be found in use in the locations checked on the accompanying pictures. In this service both horizontal and vertical loads are applied with suddenness and severity really trying the capacity of the bearings and their mountings—

Roller Bearing Units are being more and more widely used.

AMERICAN STEEL FOUNDRIES

NEW YORK CHICAGO ST. LOUIS

Such Luxury Radiates Good Will

Hale & Kilburn No. 900 Double Rotating Chair

There isn't much about any railroad trip for a passenger to write home about. To most people, cars are much alike, trainmen are all about the same—there isn't anything exciting or unusual about any train ride.

But equip a few cars with the luxury of Hale & Kilburn double chairs and every passenger will talk about it. These deeply upholstered seats are so luxurious, so restfully appealing, so completely different from any coach seats ever before used, that they put an entirely new face on railroad travel. They make people enthusiastic.

And enthusiastic praise is one thing that railroads need. It is the finest kind of publicity.

HALE & KILBURN SEATS

"A BETTER SEAT FOR EVERY TYPE OF MODERN TRANSPORTATION"

HALE & KILBURN CO.

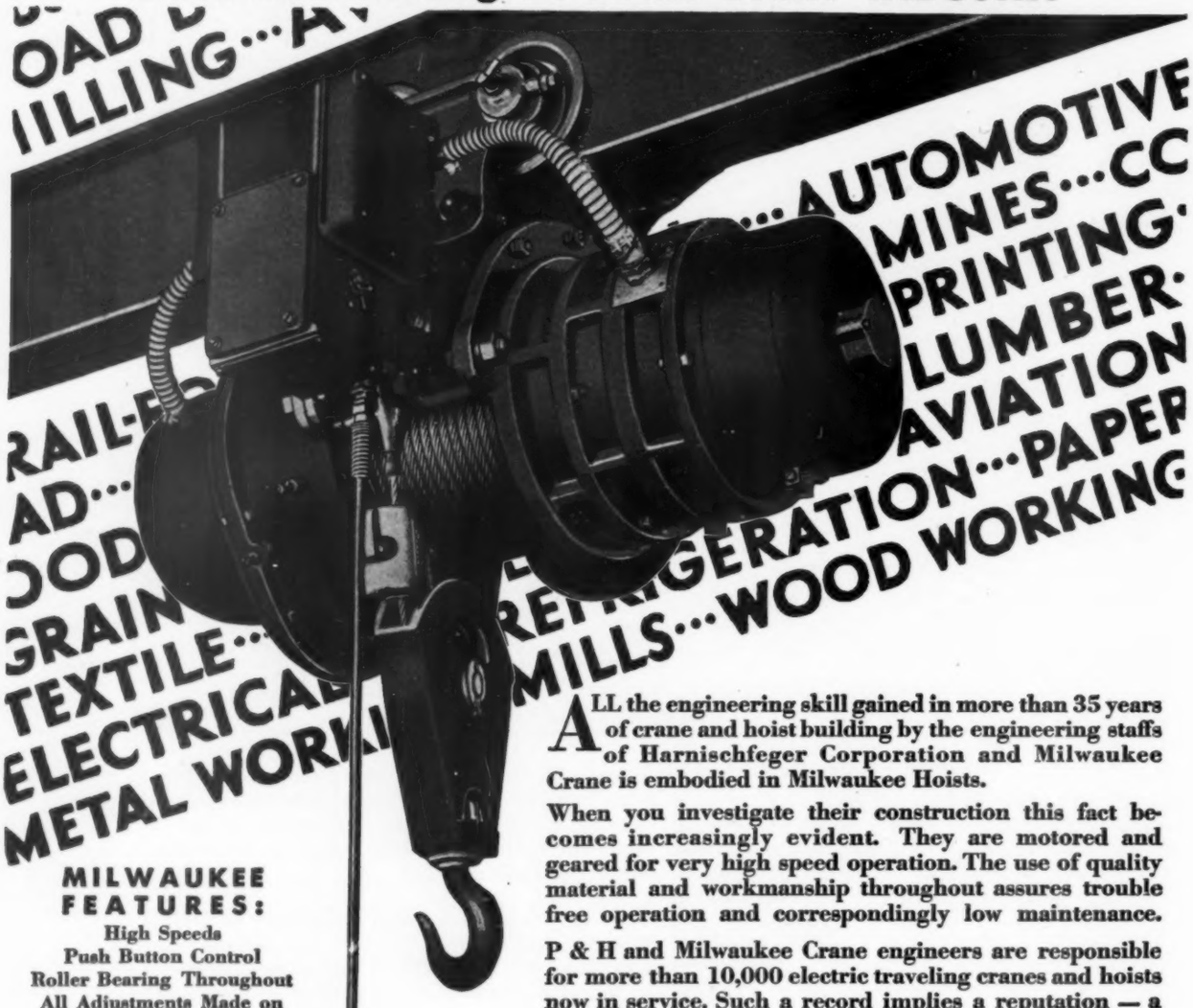
General Office and Works: 1800 Lehigh Avenue, Philadelphia

SALES OFFICES:

Hale & Kilburn Co., Graybar Bldg., New York
Hale & Kilburn Co., McCormick Bldg., Chicago
Frank F. Bodier, 905 Monadnock Bldg., San Francisco
E. A. Thornwell, Candler Bldg., Atlanta
W. L. Jefferies, Jr., Mutual Bldg., Richmond
W. D. Jenkins, Praetorian Bldg., Dallas, Texas
H. M. Euler, 53 First St., Portland, Oregon

Milwaukee Hoists

. . . . produced by Harnischfeger Corporation and Milwaukee Crane for modern, high-speed material handling . . . . IN EVERY INDUSTRY



MILWAUKEE FEATURES:

High Speeds
Push Button Control
Roller Bearing Throughout
All Adjustments Made on Outside
Double Drive Hoist Gearing
All Loads Carried by Steel Members
Limit Switch Safest Type Known to Engineers
Alloy Steel Shafts, Ground to Size
Oil Bath Lubrication for Gears and Brakes
Forged Heat-Treated Gears and Pinions
Forged Steel Trolley Wheels
Ball Bearing Motors specially designed for Hoist Service
Single or Variable Speed Control
Unusual Accessibility

ALL the engineering skill gained in more than 35 years of crane and hoist building by the engineering staffs of Harnischfeger Corporation and Milwaukee Crane is embodied in Milwaukee Hoists.

When you investigate their construction this fact becomes increasingly evident. They are motored and geared for very high speed operation. The use of quality material and workmanship throughout assures trouble free operation and correspondingly low maintenance.

P & H and Milwaukee Crane engineers are responsible for more than 10,000 electric traveling cranes and hoists now in service. Such a record implies a reputation — a reputation which Milwaukee Hoists, sponsored by these same organizations, do sustain.

Your interest in modern, high speed material handling equipment warrants your attention to Milwaukee Hoists; a request will bring complete information.

MILWAUKEE ELECTRIC CRANE & HOIST CORP.
Division of Harnischfeger Corporation
MILWAUKEE, WISCONSIN

HOISTS MILWAUKEE CRANES ROLLER BEARING CRANES

MILWAUKEE

LOW HEADROOM CRANES 3 TO 30 TONS
STANDARD CRANES TO 50 TONS

Air-Way installation in the shops of the Heisler Locomotive Works, Erie, Pa.

Shop Costs Go Down As Cool Pure Air Comes In

HEAT and poor ventilation slow-up labor in shop and office just as certainly as shivering discomfort from cold. And the Air-Way Unit Heater solves the comfort problem just as positively and economically in summer as in winter.

Air-Way Unit Heaters pay dividends in all seasons, and not a few railroads have recently learned that this increased productivity represents a financial gain comparable to a nice new profit on hauling operations. We have many interesting facts, figures and records on the profitable application of Air-Way Unit Heaters to all departments of transportation companies. You should know about it.

Air-Way
TRADE MARK
UNIT HEATER

USE THIS COUPON

Air-Way Electric Appliance Corp.
Toledo, Ohio

Please send me descriptive data on the Air-Way Unit Heater.

Name .....

Title .....

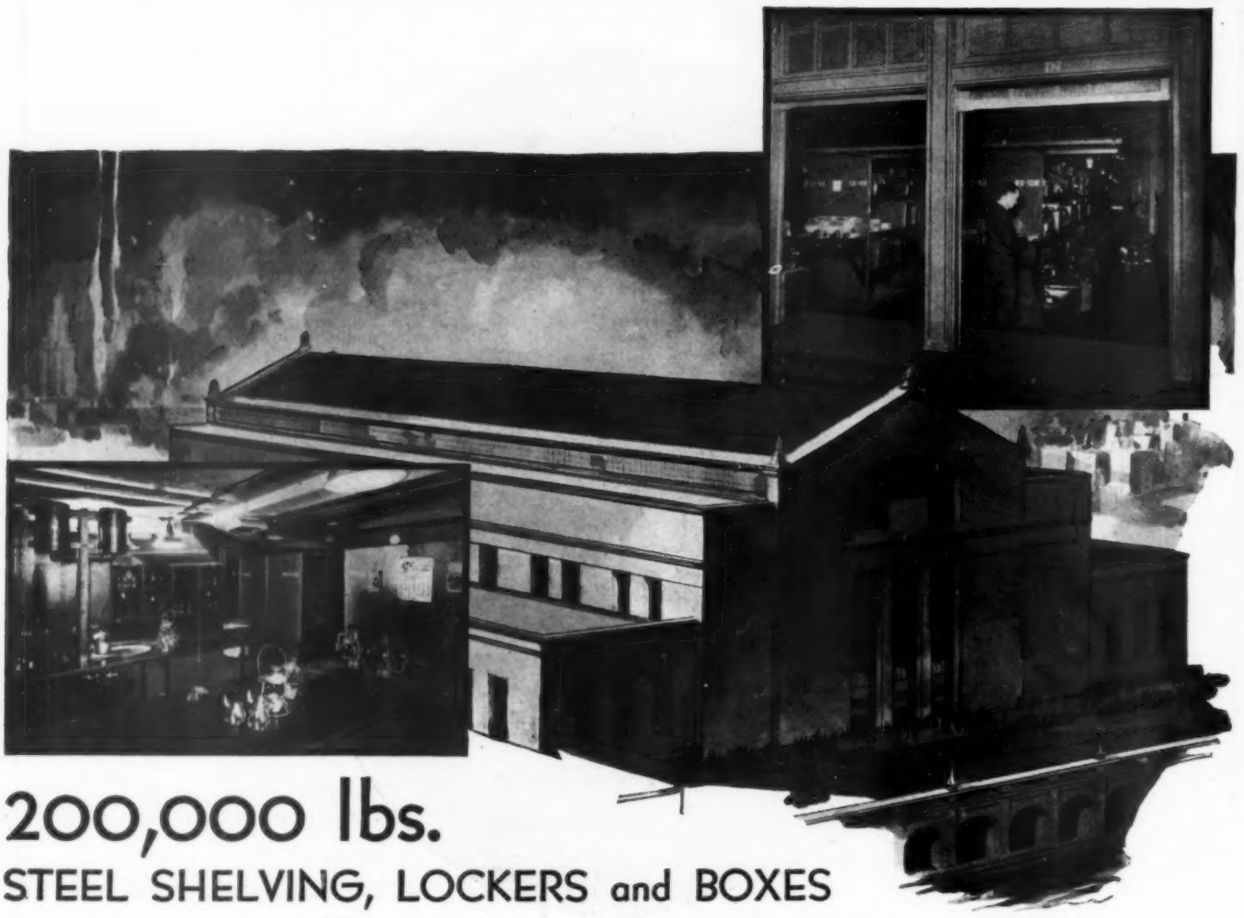
Firm .....

Address .....

R. A.

Air-Way Electric Appliance Corporation, Toledo, Ohio

(Heating Systems Division)



200,000 lbs.

STEEL SHELVING, LOCKERS and BOXES

Help Keep Chicago's Union Station Modern

HERE, in one of the largest and most modern Railway Terminals in the world, steel storage equipment plays an important part in guarding against depreciation and giving greatest service for the money invested.

Wherever storage equipment was needed, steel was used . . . from the lantern room to the parcel checking room, where approximately 3,000 pieces of baggage are handled daily. 200,000 lbs. of equipment!

Typical of the salvage value of steel products, was the fact that when the old Canal Street Station was abandoned, its used steel equipment was removed and installed in the new building.

Flat rolled steel, in many forms has become indispensable in railway construction . . . for only steel will stand up under constant usage and defeat depreciation to the greatest degree. Those interested in reducing costs and improving service with steel products in the railway field can obtain complete information by writing the Trade Research Division, National Association of Flat Rolled Steel Manufacturers, 511 Terminal Tower, Cleveland, Ohio.

Steel buildings save time, labor and money in erection and resist fire. Because they are standardized, prompt shipments are made.

Steel shelving saves 16⅔% storage space; is fireproof, has high salvage value and is readily adaptable to any need.

Save

Fire Loss

Wear

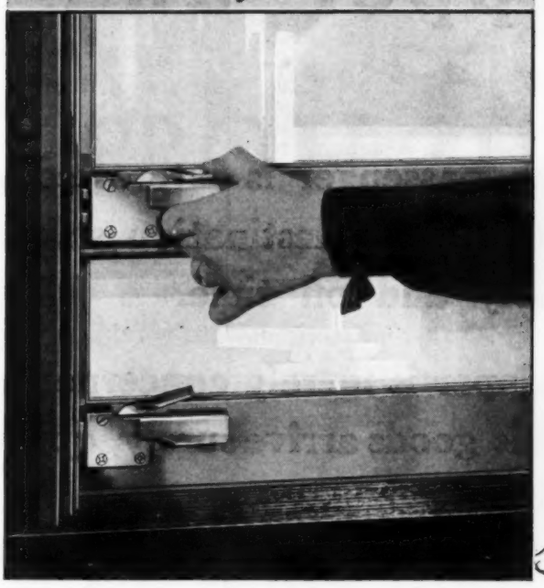
Money

with Steel Shelving

APPLIED TO BRASS SASH

The EDWARDS - *principle*

. . . wedged tight windows easily raised



Are your windows designed for "Weight-Lifters?"

Most passengers are normal human beings . . . not strong men! So Edwards Engineers designed a window that could be raised *without friction!* Release the Edwards wedge-locks and the sash is *loose*. It offers no resistance to raising except the weight of the sash itself. Yet, in position, the wedge-locks hold it in a giant grip—make it rattle-proof and, with the new weatherstrip, air tight.

That is the Edwards-*principle* that makes old design metal sash, however good it may have been in its day, obsolete.

Edwards Complete Window Installation

An achievement of Edwards Engineers that definitely locates responsibility for proper operation. Location of sash guides, parting stops, and curtain guides *cannot* be altered during installation. . . . Edwards Engineers are available to work with car builders, supervising installation.

Write for Complete Information

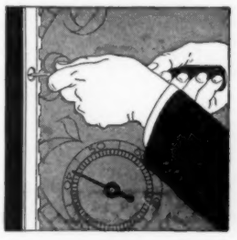
An Engineer will bring you the story—or write for a sash model and specifications.

O. M. EDWARDS CO.

NEW YORK SYRACUSE, N.Y. CHICAGO

Canadian Representatives:

LYMAN TUBE & SUPPLY CO., LTD., *Montreal & Toronto*



Two minutes—a screw-driver—a quarter turn of six locking bolts—remove the sash for reglazing. Car cleaning, repainting, or repair work take less time, cost less. No screws to remove—none to replace.

EDWARDS-*principle* SASH

The new development by Edwards Engineers to help make GOOD coaches BETTER

EDWARDS COMPLETE WINDOW INSTALLATION includes Brass Sash, Sash Locks and Hardware, Weatherstrips, Parting Stops, Sash Stops and Curtain Guides, and Cheek Plates.

See FOR YOURSELF WHY WE NAMED IT "OLD HICKORY"

The top photograph shows a stick of seasoned hickory, nicked and then bent. Below is a "nick-bend" test of Reading OLD HICKORY Staybolt Iron. The same *fibrous* structure that gives the wood its extra toughness, gives to OLD HICKORY Staybolt Iron its greater endurance.

HICKORY

What do you think of when you hear the name, "Old Hickory"? *Toughness* — staunchness — endurance far beyond the ordinary span. "Old Hickory" is the name applied to President Andrew Jackson as a term of affection and admiration in recognition of his unyielding front to opposition, iron will and iron determination. And, as "Old Hickory" was unique among men—as hickory itself is unique among woods—so is Reading OLD HICKORY Staybolt Iron unique among metals!

For Reading OLD HICKORY Staybolt Iron is *tougher* — to stand the strain of thousands upon thousands of miles of jarring and jolting in railroad work. It is *fibrous*—to endure vibration and "fatigue" long after ordinary metals have gone to the scrap heap. It is produced by the most modern, most efficient methods of checkerboard piling and rolling, and is made for just one purpose: to give the utmost safety and economy wherever metal must take hard knocks.

Let us tell you about OLD HICKORY, the better Staybolt Iron. Our nearest representative will gladly give you the profitable facts.

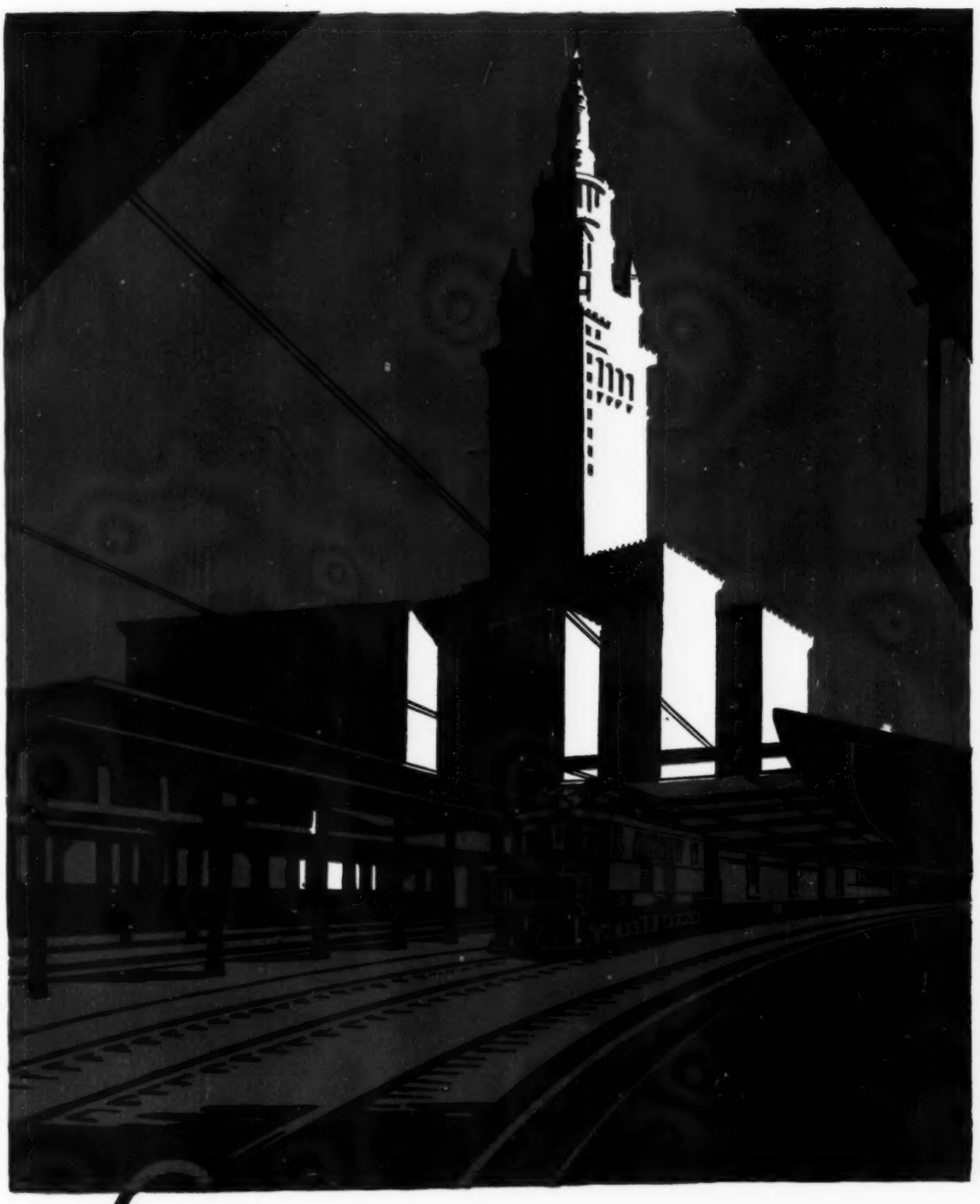
Reading Bar Iron is furnished in the following sizes:
Rounds ½" to 4½" in diameter. Squares ½" to 4".
Flats 1" x ¼" to 10" x 2". Half Rounds ⅞" to 1½".
Hexagons ⅝" to 1¾" inclusive.

READING IRON COMPANY, Reading, Pennsylvania

Atlanta • Baltimore • Cleveland • New York • Philadelphia
Boston • Cincinnati • St. Louis • Chicago • New Orleans
Buffalo • Houston • Tulsa • Seattle • San Francisco
Detroit • Pittsburgh • Los Angeles • Kansas City

Every cross-section etch test of Reading OLD HICKORY Staybolt Iron shows a perfect checkerboard!

READING
OLD HICKORY STAY BOLT IRON



CLEVELAND UNION TERMINALS

THE new Cleveland Union Passenger Terminal comprises a monumental gateway into the great city which it is designed to serve. It epitomizes the will to render the best in railway transportation by the carriers that entered into the project. But it is more than this—it represents a distinct step forward in passenger terminal development.

Casting all precedents aside, the designers of the new terminal proceeded with their work with two objectives in mind—to provide an adequate and commodious station and to secure a commercial development of the site that would insure the maximum of economic utilization.

The result is not the work of one mind, but of many. By the same token, the process of construction, whereby great structures and well appointed facilities have been brought to completion, has required the energies and resources of many firms of manufacturers and builders. Each of them has exerted his measure of influence on the result.

The building of the Cleveland Union Terminal cannot but have a marked effect upon the railway transportation industry, not only through improved service to the public locally, but also through its influence on the design and construction of future station facilities throughout the country. It is in recognition of this fact that the *Railway Age* presents a comprehensive review of the important work of the railroads, the engineers and contractors, and of the materials and equipment which were used.

CLEVELAND UNION TERMINALS

H. D. JOUETT, Chief Engineer
Graham, Anderson, Probst & White—Architects

General Contracts for the following Terminal Projects were executed by this company:

Cleveland Union Station
Prospect & Huron Road Viaducts
Electrification & Protection Piers
Locomotive Inspection & Repair Shops
Harvey Concession Spaces
Yard Facility Buildings
Coach Yard Platforms
Union Trust Bank Terminal Branch
The Midland Bank Building

ARONBERG-FRIED COMPANY INC.

New York **BUILDERS** Cleveland


CLEVELAND UNI
Chief Engineer
H.D. Jouett
CENTRAL NATIONAL BANK
SUPERIOR AVE.
PROSPECT AVE
WEST 3 RD


ON TERMINALS
Architects
Graham, Anderson
Probst and White
ONTARIO ST.
WEST 2ND
ROAD

CLEVELAND
TERMINAL TOWER BUILDING
AND
PIERS FOR CUYAHOGA VALLEY
TERMINAL APPROACH

BUILT BY
JOHN GILL & SONS
CLEVELAND
OHIO

FINE LATH *and* P

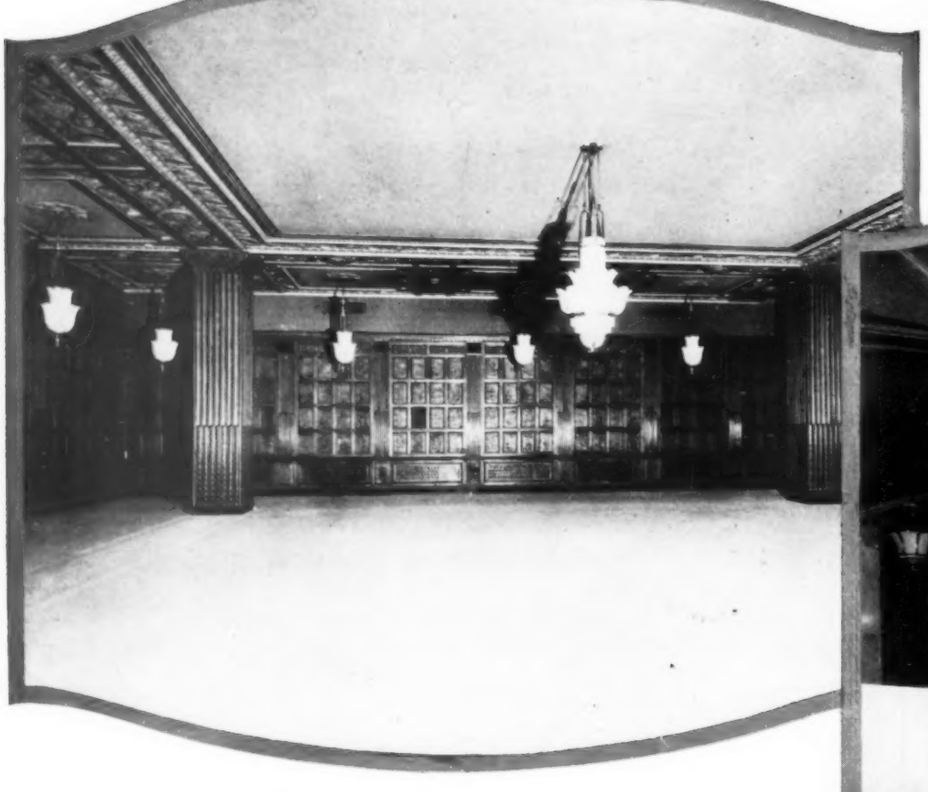
THE Bagnall-Taylor Company extends heartiest felicitations to the management, Chief Engineer, Architects and General Contractors on the successful completion of this magnificent achievement.

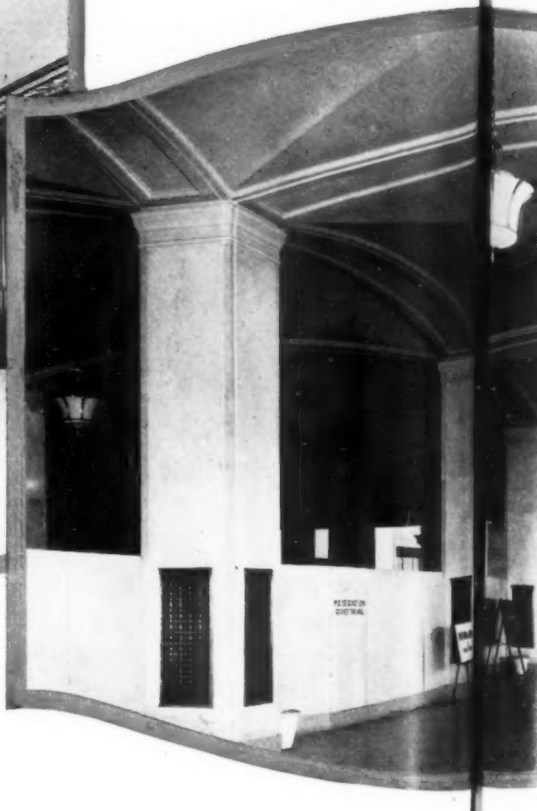
The high quality materials used in executing our contracts on the Station Proper, Signal Tower, Electric Locomotive Shops and Union Trust Terminal Branch were manufactured by the following companies:

THE KELLEY ISLAND LIME & TRANSPORT CO.
(Tiger Finish Hydrated Lime)
TRUSCON STEEL CO.
NATIONAL GYPSUM CO.

THE BAGNALL-T

Hippodrome Annex





PLASTER CRAFTSMANSHIP

THE new Cleveland Union Terminal stands majestically as an excellent tribute to the high standard of generalship, the high quality of materials, and the skilled workmanship that lend permanent beauty and utility and result in lasting economies.

The Bagnall-Taylor Company was selected to do the lath and plastering work for many reasons. Its experience of a quarter of a century, its efficient and well organized personnel, its reputation for executing every detail thoroughly and adhering rigidly to specifications and schedules.

Other examples of The Bagnall-Taylor Company's fine lath and plastering craftsmanship are found in such high class buildings as Halle Bros. in Cleveland, University School, Cleveland, O'Neil Department Store, Akron, Central-United Bank Building, Cleveland and the Moreland Courts Apartments, Cleveland.

BAGNALL-TAYLOR CO.

Cleveland, Ohio

The Union Terminal
Cleveland, Ohio

Architects: Graham, Anderson, Probst & White. Gen'l Contractors: John Gill & Sons. Plastering Contractor: P. J. Holmes.

SPECIFIED ✓ *because these plasters are superior*

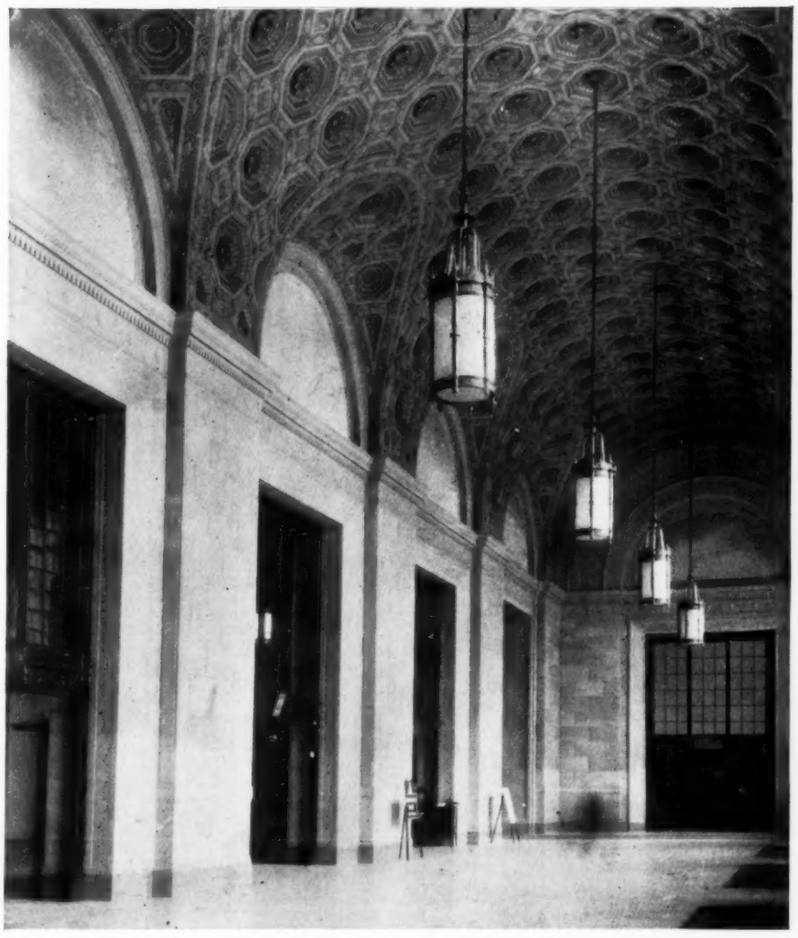
Beauty and utility are inseparably linked through every detail of such a structure as Cleveland's new Union Terminal Station. The skill of craftsman and artist must be expressed in materials that are enduring. That is why hundreds of tons of Beaver American Plasters were specified on this building. Also, the specifying of Sunflower Molding Plaster for making run molds, cornice, beam and ornamental work, means that this famed plaster meets the most rigid of scientific standards. It "works" and "runs up" easily; gives unusual coverage. These plasters are popular in all parts of the country—being used on many of the nation's finest buildings. But—a quick glance at the charming decorative work in this new Terminal gives further proof that Beaver American Gypsum Plasters and Sunflower Molding Plaster ideally fit the union of beauty and utility. Specified by leading architects.

BEAVER DIVISION

of the

Certain-teed Products Corporation

General Offices:
100 East 42nd St., New York City



PAINTING AND DECORATING

CLEVELAND TERMINAL STATION
TOWER BUILDING
MEDICAL ARTS BUILDING
MIDLAND BANK
BUILDERS EXCHANGE

By

W. P. NELSON COMPANY

CHICAGO CLEVELAND NEW YORK

Architects
Graham, Anderson, Probst & White

Chief Engineer
H. D. Jouett

For Quick and Economical Construction

THE application of Rackle Precast Roof and Fireproof Tile on this vast Cleveland Union Terminal Project was a big factor in the adoption and maintenance of a fast smooth-running construction schedule which resulted in worthwhile economies.

Rackle Precast Tile made possible the elimination of the slow and cumbersome method of pouring concrete in place, requiring supporting walls, expensive wood forms and the placing of reinforcing steel. Furthermore, the construction schedule was not interrupted or retarded by bad weather conditions because Rackle Precast Tile can be laid as easily in winter as in summer.

On every Rackle installation you are assured that experienced men execute every detail in the layout, manufacture and erection of each job, and the firm stakes its reputation on giving satisfactory service and materials that result in lasting economy.

Among the other railroad companies which have used Rackle Roofing Tile are the Texas & Pacific Railroad Co., at Fort Worth, Texas, the Chicago, Rock Island & Pacific Railroad Co., at Silvis, Ill., the Baltimore & Ohio Railroad, Baltimore, Md., and the New York, Chicago & St. Louis Railroad, Cleveland.

The Geo. Rackle & Sons Co.

Cleveland, Ohio

— Established 1870 —

CLEVELAND UNION TERMINALS

HEATING — VENTILATING — PLUMBING

Back of Railway Preference for Webster Systems of Steam Heating is a Record of Performance & Progress

THE opening of the Cleveland Union Terminal emphasizes once again that "railroading" has ceased to be mere transportation operation—it is hotel keeping, office building renting, property management, building construction, aircraft development, motor car parking, etc., etc.... hardly any field of human endeavor is missed.

In every field of modern "railroading" one finds buildings playing an important part—buildings that must be heated; many with heating systems modern and up-to-date when first installed, but quickly obsolete *unless continually kept up-to-date.*

With heating playing such an important part, is it not time to ask the question, "Is the heating budget susceptible of *marked reduction* through adoption of improved methods—through a well-planned *program of modernization?*"

Missouri Pacific Office Building. Missouri Pacific Railroad—L. W. Baldwin, President, E. A. Hadley, Chief Engineer, E. M. Tucker, Architect, Bradley Heating Company, Heating Contractor. Heated by a Webster MODERATOR System of Steam Heating "Controlled-by-the-Weather."

In strictly railway buildings for almost two decades maintenance men have habitually preferred Webster System equipment for replacements through definite knowledge of the *long life* inbuilt into every item of the "Webster line."

When railway executives have called in specialists from other fields they have found architects, engineers, building managers, hotel operators and others giving ready recognition to Webster Systems as the top-notch products of their kind.

Two-thirds of the buildings in the Cleveland Union Terminal Tower Group are equipped with Webster Systems of Steam Heating—the same systems used in outstanding railway office, hotel and other buildings throughout the United States and Canada.

Follows a list of Webster System installations by A. R. Brueggeman Company, Heating Contractors for the entire Cleveland Terminal Group:

Maternity Hospital	Cleveland
Babies' & Children's Hospital	"
Sterling & Welch Co.	"
Halle Bros. Co.	"
Union Terminal Tower	"
Union Terminal Tower, Unit B	"
Shaker Square Bldg. "A"	"
Terminal Group Viaduct	"
Terminal Group Garage & Bldgs.	"
Terminal Group Signal Station	"
Terminal Group Station Bldg.	"
Houserman Co., E. F.	"
Osborn Mfg. Co.	"
Shaker Square Bldg. "C" & "D"	"
	Shaker Hts., Ohio
Nissen Building	Winston-Salem, N. C.
First Nat'l Bank	Charlotte, N. C
Northern N. Y. Development	Albany, N. Y
Onota Building	Pittsfield, Mass
Fox Theatre Office Bldg.	Brooklyn, N. Y.
Fox Theatre Office Bldg.	St. Louis, Mo.
Fox Theatre Office Bldg.	Detroit, Mich.

The cost of fuel for heating the non-railway buildings operated by American railroads, if considered in the aggregate, constitutes a major item of expense. Recognition of this truth by two of America's leading railway systems resulted in their being among the first to adopt "Controlled-by-the-Weather" heating with Webster MODERATOR Systems for two outstanding structures, The Missouri-Pacific Office Building and the Canadian Pacific Royal York Hotel as illustrated on this page.

These two buildings are typical of thirty-seven outstanding structures now being heated by Webster MODERATOR Systems of Steam Heating. In these buildings control

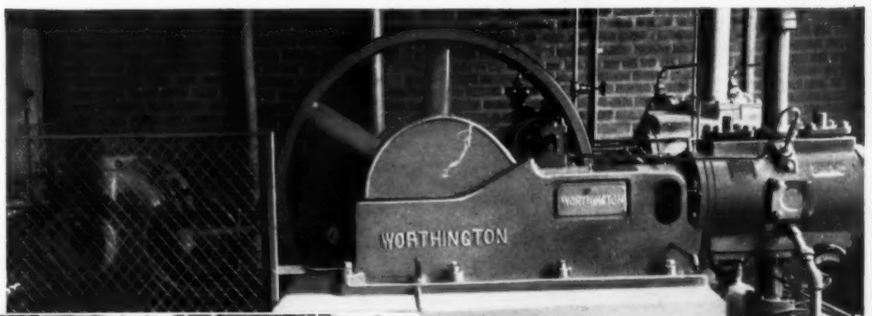
Royal York Hotel, Toronto. The largest hotel in the British Empire. Constructed and operated by the Canadian Pacific Railway, E. W. Beatty, President, J. M. R. Fairbairn, Chief Engineer, Ross & MacDonald, Architects, Sproat & Rolph, Assoc. Architects, James Ballantyne, Heating Contractor. Darling Bros., Ltd., Canadian representatives. Heated by a Webster MODERATOR System of Steam Heating, with heating "Controlled-by-the-Weather," assuring maximum comfort to guests.

THE A. R. BRUEGGEMAN COMPANY

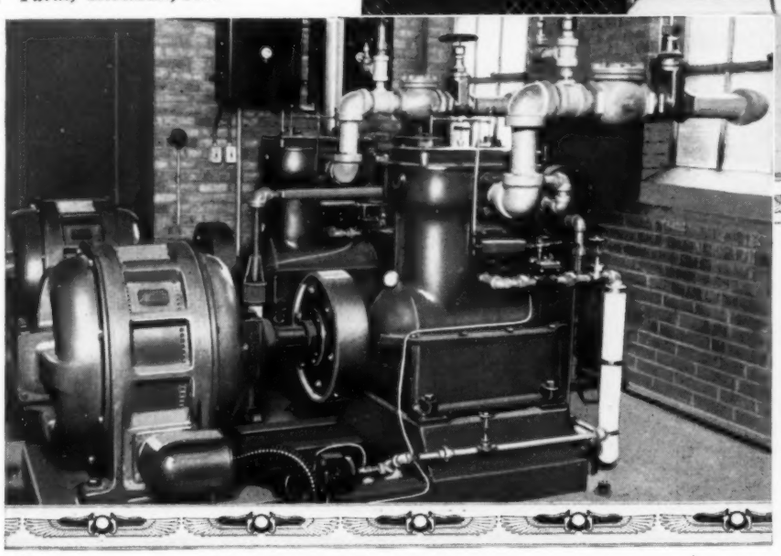
TERMINAL TOWER CLEVELAND, OHIO

CLEVELAND UNION TERMINALS

HEATING — VENTILATING — PLUMBING



Worthington Vertical Duplex Compressors and Horizontal Duplex 2-stage Compressor at the Collinwood Yards, Cleveland, Ohio



PUMPS
COMPRESSORS
Stationary and Portable
CONDENSERS
and Auxiliaries
DIESEL ENGINES
GAS ENGINES
FEEDWATER HEATERS
WATER, OIL and
GASOLINE METERS
MULTI-V-DRIVES
CHROMIUM PLATING

Literature on request

Built by Worthington...
Installed by Brueggeman

AT the Collinwood Yards and Linndale Yards of the New York Central Railroad, at Cleveland, all of the air compressors are Worthingtons.

There are two 7″ x 6″ vertical duplex compressors, with air receivers and accessories, at each of the yards, and one 12″/7½″ x 9″ horizontal duplex 2-stage compressor at the Collinwood Yards.

In addition to this equipment installed by The A. R. Brueggeman Company, Worthington is represented at each of the yards by two 6″ x 4″ x 6″ direct-acting pumps, operated by compressed air and used for the transfer of oil.

On the completion of the Terminal Project, Worthington congratulates the City of Cleveland and the men responsible for its accomplishment.

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION

Works: Harrison, N. J. Cincinnati, Ohio Buffalo, N.Y. Holyoke, Mass.

Executive Offices: 2 Park Avenue, New York, N.Y.

GENERAL OFFICES: HARRISON, N. J

District Sales Offices and Representatives:

ATLANTA	CHICAGO	DALLAS	EL PASO	LOS ANGELES	PHILADELPHIA	ST. PAUL	SEATTLE
BOSTON	CINCINNATI	DENVER	HOUSTON	NEW ORLEANS	PITTSBURGH	SALT LAKE CITY	TULSA
BUFFALO	CLEVELAND	DETROIT	KANSAS CITY	NEW YORK	ST. LOUIS	SAN FRANCISCO	WASHINGTON

Branch Offices or Representatives in Principal Cities of all Foreign Countries

R-59

THE A. R. BRUEGGEMAN COMPANY

TERMINAL TOWER CLEVELAND, OHIO

Johns-Manville Service to Transportation meets old Friends . . . at Cleveland

MANY J-M products have entered into the construction of Cleveland's new terminal—products that have served the railroads for over 50 years. Johns-Manville serves this great terminal as it does the roads which enter it.

Johns-Manville takes genuine pride in the part it has been able to play in the construction of this important rail gateway. In calling upon the best of engineering skill and knowledge for this project it is only logical that the best in materials were also employed. That so many J-M materials were chosen for this new terminal demonstrates again Johns-Manville's Service to Transportation.

Today, Johns-Manville offers Modern Transportation hundreds of products to help increase operating efficiency, improve passenger comfort and reduce maintenance costs on the railroad, on the highway, and in the air. From coast to coast Johns-Manville Service, resources and manufacturing facilities are at your command.

These J-M Products Serve the new Cleveland Terminal

J-M Built-up Roofing on Terminal Tower Building.
J-M Class "A" Built-up Roofing on Station Portion Building.
Furnishing of J-M Mastic protection over Waterproofing Membrane on streets passing through the Terminal area.
J-M Ebony Asbestos Panels for all electrical control boards.
J-M Acoustical Treatment in lunch rooms and station. (Nashkote)
J-M 85% Magnesia Pipe Covering and Cold Water Insulation in Terminal Station.
J-M Asbestos Ebony Insulation for Catenary Bridges.

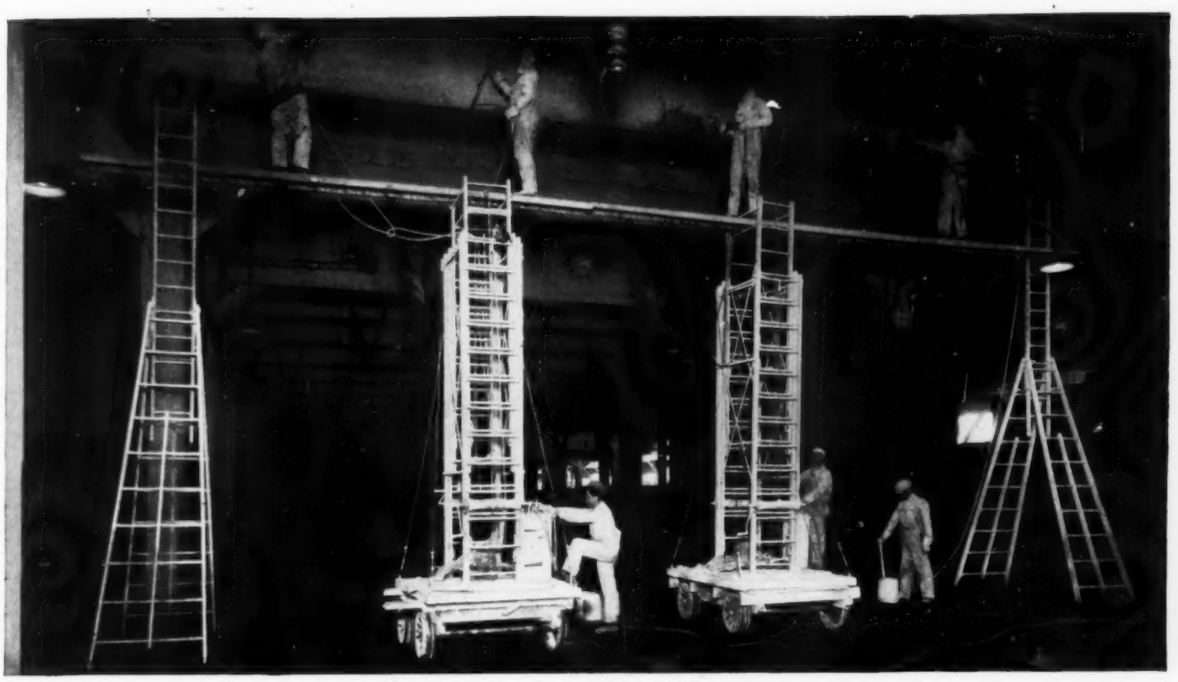
• • •

Graham, Anderson, Probst & White, Chicago, Ill.—Architects.
John Gill & Sons, Cleveland, Ohio—General Contractors for Cleveland Terminal Tower.
Aronberg & Fried, New York, N. Y.—General Contractors for the Union Terminal.
H. D. Jouett, Chief Engineer—Cleveland Union Terminals.
Industrial Asbestos & Supply Co., Cleveland, Ohio—Approved J-M Roofing Contractors.
A. R. Brueggeman Company, Cleveland, Ohio—Heating and Plumbing Contractors.
Rankin-Dutney Corporation, Cleveland, Ohio—Insulation Contractors.

JOHNS-MANVILLE
JM
PRODUCTS

Johns-Manville
SERVICE TO TRANSPORTATION

Packings Refractory Cements Transite Insulations Celite for Concrete Car and Bus Flooring
Ready-to-lay Roofing Fireproof Bridge Decking Waterproofing Built-up Roofing Masticoke Flooring
Asbestos Shingles Smoke Jacks Bus and Airplane Insulation Electrical Parts Transite Pipe
Passenger and Refrigerator Car Insulation Friction Tape Brake Lining Brake Blocks Insulating Tape



Painting in the Cleveland Union Terminal with MEDUSA PORTLAND CEMENT PAINT

The illustration above shows painters at work in the new Cleveland Union Terminal spraying Medusa Portland Cement Paint on the concrete roof and columns on the track level. This paint was also used in the interior of the baggage, express and mail rooms, taxicab stand, etc.

Medusa Portland Cement Paint has many advantages in railroad work. It prevents disintegration, increases the light reflecting value and beautifies. It is unaffected by exposure to the elements and resists the chemical action of lime and alkalies, hence will not peel, scale or dust off, but remains as permanent protection. It is particularly advantageous in the painting of both inside and outside of warehouses where freight is stored, since its damp-proofing qualities make a dry warehouse.

This unusual paint can be applied to damp surfaces, which makes it particularly desirable for painting fresh concrete or masonry, thereby making it unnecessary to wait until a wall has dried out before painting. Medusa Portland Cement Paint comes in six colors and white and can be applied by spray equipment or Dutch brush.

A generous testing sample will be sent to railway departments in charge of new construction and maintenance upon request.

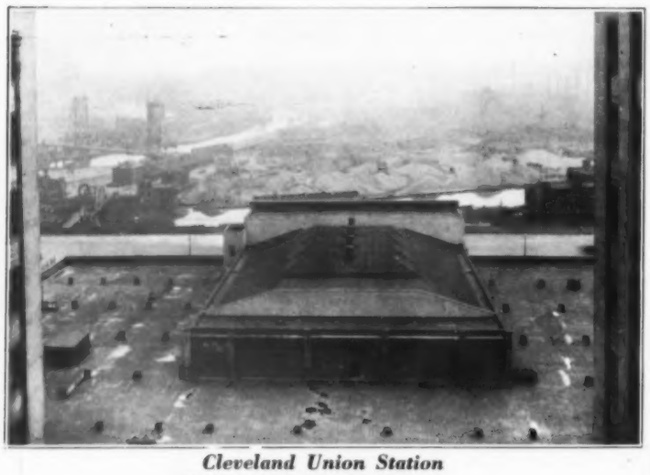
Write today for a copy of this book on "How to Paint Concrete and Masonry Surfaces". It gives all the advantages, uses and specifications for Medusa Portland Cement Paint.

MEDUSA PORTLAND CEMENT COMPANY

1002 Engineers Bldg. Cleveland, Ohio

Manufacturer of Medusa Gray Portland Cement (Plain and Waterproofed); Medusa Waterproofing (Powder or Paste); Medusa White Portland Cement (Plain and Waterproofed); Medusa Portland Cement Paint and Medusa-Mix, the Masonry Cement

MEDUSA



Cleveland Union Station
H. D. Jouett, Chief Engineer
designed by
Graham, Anderson, Probst and White
Architects
Aronberg, Fried Company, Inc., Builders
Here 560,000 feet of Celotex were used to insulate floors and roofs.

In the Cleveland Union Terminal *Celotex Shuts Out Heat and Cold*

IN the new Union Terminal Building, Cleveland, Ohio, 560,000 square feet of Celotex were used to protect patrons from all extremes of temperature.

Above the building stretches a great roof exposed to scorching summer heat and bitter winter cold.

Below is the unheated train shed from which cold seeks to penetrate the rest of the building.

So both roofs and floors were insulated with Celotex to insure the comfort of the public and the employees—through every season of the year.

Celotex was selected in preference to all other materials partly on account of its high resistance to the passage of heat, proved in thousands of railway buildings—and partly because of its low cost of application.

It is quickly and easily applied in new or old buildings. Celotex Standard Building Board gives lasting strength to walls and roofs. Celotex Lath makes a better base for plastered interiors. And Celotex Roof Insulation Board is laid over any type of roof deck or right over the old built up roofing.

Leading railroads use millions of feet of Celotex every year, not only in passenger terminals but in freight stations, offices, section houses, tool houses and all types of buildings . . . to provide year 'round comfort and cut winter heating costs.

Write for complete information on Celotex and its numerous uses in railway buildings. Address the Railroad Department.

THE CELOTEX COMPANY
919 North Michigan Ave.
Chicago, Illinois

Branch Sales Office:
101 Park Avenue, New York City
Mills: New Orleans, La.

The word
CELOTEX
Reg. U. S. Pat. Off.
is the trademark of and indicates
manufacture by
The Celotex Company, Chicago, Ill.

CELOTEX
BRAND
INSULATING CANE BOARD
ROOF INSULATION

Fairbanks Scales used in new Cleveland Terminal

WHEN revenue is based on weight—scale accuracy is important. It is significant, then, that Fairbanks Scales are used on almost every railroad in the world. Adoption of Fairbanks Scales for the new Cleveland Union Terminal is another eloquent testimonial of the confidence that is placed in Fairbanks dependability and accuracy by men who know values.

In the Cleveland Union Terminal, ten modern Fairbanks Scales are used to protect carrier's revenue and to insure fair dealing for those who use these facilities. The equipment includes three 10,000-lb. dial scales, six 1000-lb. dial scales and one 800-lb. beam scale. Back of these scales—and *all* Fairbanks Scales—is the practical experience of 100 years of scale building. The Fairbanks name is synonymous with "accurate weight" throughout the world.

But it is not for scales alone that the railway industry

{continued on next page}

Fairbanks Dial Scale. One of the many Fairbanks Scales which assure fast, accurate weighing of baggage and freight in the new Cleveland Union Terminal.

1930 begins the **SECOND CENTURY** of building **FAIRBANKS SCALES**

FAIRBANKS SCALES

POWER, PUMPING AND WEIGHING EQUIPMENT

Photograph shows a loaded baggage truck on the Fairbanks Beam Scale which is installed in the baggage room of the new Cleveland Union Terminal.

{continued from preceding page}

turns to Fairbanks-Morse. On the rails of a continent, Fairbanks-Morse "Sheffield" Railway Motor Cars have proved their claim to being the "lowest over-all cost cars on the market." Fairbanks-Morse—America's largest manufacturer of Diesel engines—is consulted when a dependable, low cost solution to power problems is sought. F-M Ball Bearing Motors turn the wheels of machinery in modern plants and shops. Pumps from the complete F-M line are specified—with absolute confidence—to handle pumping requirements of every kind.

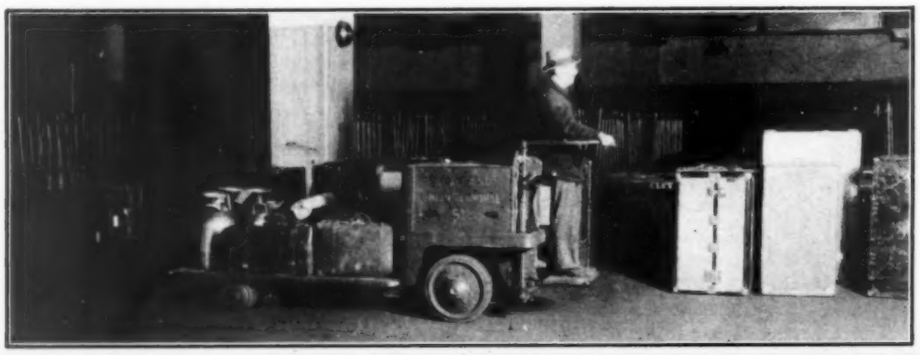
1930 begins the SECOND CENTURY of building FAIRBANKS SCALES

It is natural that Fairbanks-Morse products should be used extensively by the railway industry—and by industry in general. A diversified line carries the well-known F-M trade-mark. Each of these F-M products is backed by an enviable performance record. Each is protected by the guaranty of one of America's pioneer manufacturing institutions.

FAIRBANKS, MORSE & CO., Chicago

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.

General view of the baggage room in the Cleveland Union Terminal where modern Fairbanks Scales speed up the work and assure accurate weighing.



RSA21.3

FAIRBANKS SCALES

POWER, PUMPING AND WEIGHING EQUIPMENT

KINNEAR ROLLING DOORS
—as usual

Graham, Anderson, Probst & White, Architects

AT THE NEW CLEVELAND UNION TERMINAL

FOR over twenty-five years Kinnear Rolling Doors have been demonstrating their efficiency and eminently satisfactory performance in nearly all the great terminals of the country. It was but logical, therefore, that they should have been selected for the baggage room of the magnificent new Cleveland Union Terminal.

At the touch of an electric button they glide up and down —conserving valuable time and space—giving the utmost in door efficiency. When planning new, or the improvement of existing structures do not overlook their many advantages. Literature and estimates furnished without charge or obligation.

PRECISION ENGINEERING

THE KINNEAR MANUFACTURING CO.
876-900 Field Avenue, Columbus, Ohio, U. S. A.

Boston Chicago Cincinnati Cleveland Detroit New Orleans
New York Philadelphia Pittsburgh Kansas City Washington

kinnear
ROLLING DOORS

KREOLITE

Odorless WOOD BLOCK FLOORS

are laid in the Express, Baggage, Mail and Milk Rooms, Platforms and Truck Passages and Electric Shops of the

CLEVELAND UNION TERMINAL

Graham, Anderson, Probst & White, Chicago, Architects. H. D. Jouett, Chief Engineer. Cleveland Union Terminal, Cleveland, O.

THE growing preference for Kreolite Blocks, as exemplified by their extensive use in this magnificent terminal, is due to their adaptability, durability and lasting economy. They are performing successfully under widely divergent conditions because—

1st—They are properly designed—the same type of block is not recommended for all conditions.

2nd—They are manufactured from carefully selected, properly air-seasoned Long Leaf Yellow Pine Lumber.

3rd—They are properly treated with the proper grade of our own Kreolite Oil distilled from our own stills.

4th—They are properly laid in strict conformance with Kreolite standard specifications under Kreolite expert supervision.

THE JENNISON-WRIGHT COMPANY, Toledo, Ohio

Branches in All Large Cities

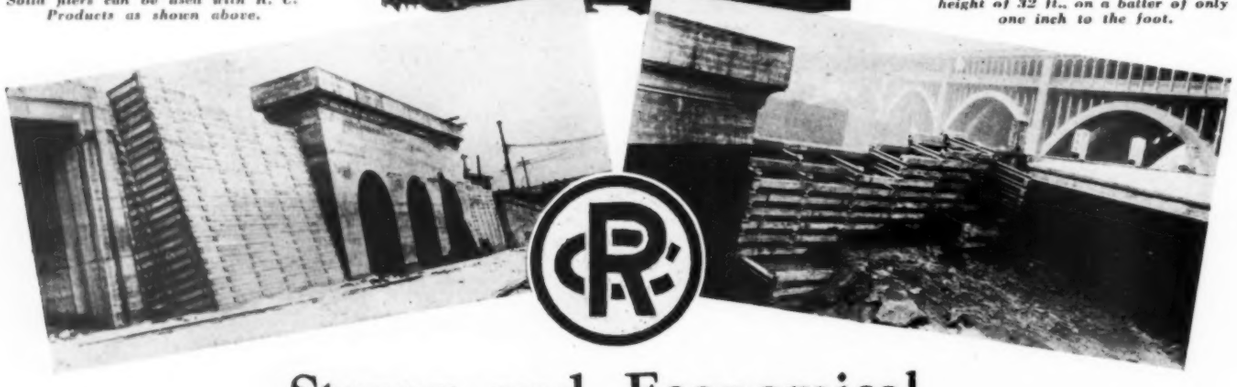
WOOD BLOCK FLOORS

R. C. Retaining Walls

Automatic Interlocking Flexible

R. C. Walls for embankment carrying re-located Columbus Road. Solid filers can be used with R. C. Products as shown above.

This R. C. Wall was built to a height of 32 ft., on a batter of only one inch to the foot.



Strong and Economical

IN this new Cleveland Union Terminals Project with its quality products and highest type of engineering throughout are many permanent retaining walls built of R. C. Pre-Cast Concrete Units.

In strength and appearance they meet the high standards of this great construction job. Long experience proves they are reliable and very economical.

R. C. Units can be easily and quickly erected by unskilled and low-priced labor. They can be salvaged and used over because they are immune from injury due to the elements.

R. C. Units permit all year work for zero weather does not interfere with R. C. construction.

Our large stock of perfectly cured units assures prompt delivery.

The R. C. Products Company, Inc.

Engineers Building, Cleveland, Ohio

New York Chicago Buffalo Pittsburgh Los Angeles
St. Louis Keyser, W. Va. Detroit

R. C. Walls along right of way Norfolk and Western manufactured and installed by R. C. Products Co.

R. C. Wall used by the Pennsylvania R. R. at its No. 1 Coal Dock at Sandusky, Ohio.

White Six-Cylinder, heavy-duty truck, equipped with power dumping body

200 Whites Help Speed Construction of Cleveland Union Terminal

WHEREVER there is big construction work you will find White Trucks on the job—toiling economically and dependably in all kinds of weather—in and out of deep, hard going excavations.

In building the Cleveland Union Terminal more than 200 White Trucks were used in excavating work and for the transportation of supplies, giving the same dependable performance that characterizes the work of Whites in every field of motor transportation.

For Whites there's no job too big. They have the power for any purpose . . . . speed when you want speed . . . . reserve strength when needed. They have the stamina to stay on the job.

The White Truck line is complete—fours and sixes—a size and type for every hauling requirement. Various types of bodies and power hoists, including concrete truck mixer, agitator and concrete conveyor bodies are available.

THE WHITE COMPANY, *Cleveland*

WHITE TRUCKS

and WHITE BUSSES

In Cleveland's Great

CLEVELAND UNION TERMINAL BUILDINGS
Cleveland, Ohio

Architects:
Graham, Anderson, Probst & White,
Chicago, Ill.

General Contractors:
Lundoff — Bicknell Company, Cleveland, Ohio
John Gill & Sons, Cleveland, Ohio
Aronberg-Fried Company, Cleveland, Ohio

Chief Engineer:
H. D. Jouett, Cleveland, Ohio

Among the materials used in this construction were the following products from Subsidiary Manufacturing Companies of the United States Steel Corporation:

American Bridge Company
Fabricated Structural Steel Work for buildings and viaducts.

American Sheet and Tin Plate Co.
Apollo Galvanized Sheets.

American Steel & Wire Company
Wire Rope, Wire Fabric Reinforcement, Nails, Rail Bonds, Wire Strand, Electrical Wires and Cables.

Carnegie Steel Company
Carnegie Beams, Structural Materials, Rails.

Cyclone Fence Company
Copper-Steel Chain Link Fence and Pipe Railing.

Illinois Steel Company
Structural Shapes, Plates and Bars.

The Lorain Steel Company
Cast Steel Foundation Plates.

National Tube Company
National Pipe and Conduit.

Universal Atlas Cement Company
Universal and Atlas Cement.
Atlas White Portland Cement

Terminal Project

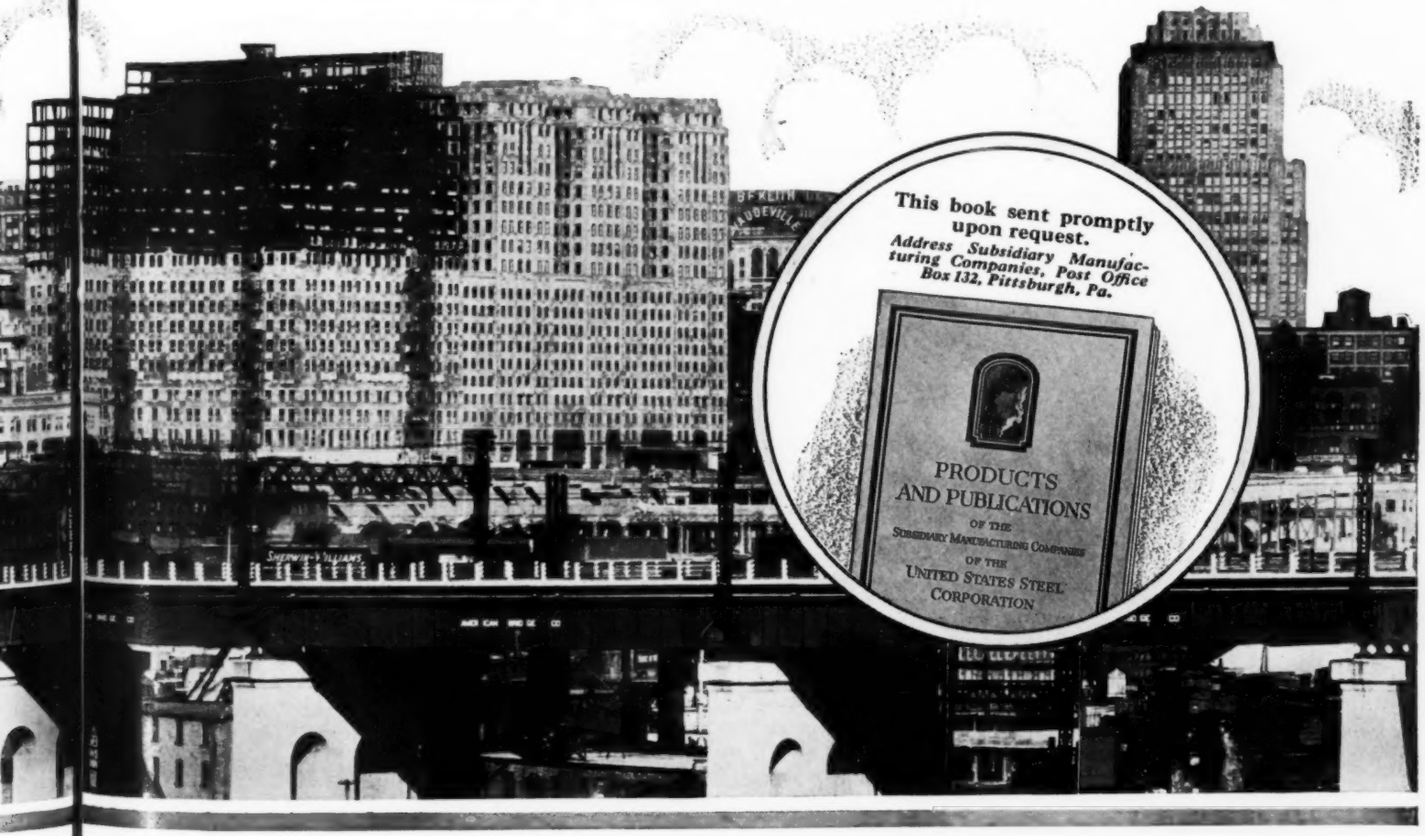
The magnificent Cleveland Terminal—one of the outstanding construction projects of recent years—affords an excellent opportunity to visualize the complete service offered by one of America's leading industrial organizations. From the massive foundations to the pinnacle of the central tower, the products of the principal Subsidiary Manufacturing Companies of the United States Steel Corporation serve in some important capacity. Not only the main buildings and foundations, but the ramps, viaducts, paving, tracks, conduits, approaches and enclosures—all required the extensive use of Steel and Concrete.

Just as a close cooperation and organization of working forces has been necessary to erect this splendid project, so a closely coordinated organization, working hand in hand in mutual giving and taking of practical experience and manufacturing ability, has furnished products essential to its construction. Future years of long life and satisfactory service will demonstrate the many benefits to be derived from using, wherever possible, products from one source of supply, where the factor of quality and service has been the keynote of production.

Principal Subsidiary Manufacturing Companies of the UNITED STATES STEEL CORPORATION

AMERICAN BRIDGE COMPANY
AMERICAN SHEET AND TIN PLATE COMPANY
AMERICAN STEEL AND WIRE COMPANY
CARNEGIE STEEL COMPANY
CYCLONE FENCE COMPANY
FEDERAL SHIPBUILDING AND DRY DOCK COMPANY
ILLINOIS STEEL COMPANY
MINNESOTA STEEL COMPANY
NATIONAL TUBE COMPANY
THE LORAIN STEEL COMPANY
TENNESSEE COAL, IRON & R. R. COMPANY
UNIVERSAL ATLAS CEMENT COMPANY

Pacific Coast Distributors–United States Steel Products Co., Columbia Department: San Francisco, Los Angeles, Portland, Seattle, Honolulu. *Export Distributors*–United States Steel Products Co., New York City



Chosen for Quality and Service

..in Cleveland's Great Terminal.

Recognized as a national standard for quality and service, it was only natural that American Steel & Wire Company products should be specified in the construction of the magnificent new Cleveland terminal.

American Steel & Wire Company Wire Rope, Wire Fabric Reinforcement, Nails, Rail Bonds, Wire Strand and Electrical Wires and Cables, will all play an important part in the development and efficient operation of this remarkable project.

The same degree of service and quality is available to you. Complete information covering any of your needs will be furnished on request—and will involve no obligation.

Cleveland Union Terminal Buildings
Cleveland, Ohio
Architects:
Graham, Anderson, Probst & White, Chicago, Ill.
General Contractors:
Lundoff & Bicknell Co. Cleveland, Ohio
John Gill & Sons Cleveland, Ohio
Aronberg-Fried Company, Cleveland, Ohio
Chief Engineer:
H. D. Jouett, Cleveland, Ohio

AMERICAN STEEL & WIRE COMPANY

SUBSIDIARY UNITED STATES STEEL CORPORATION

208 S. La Salle Street, Chicago — 30 Church Street, New York

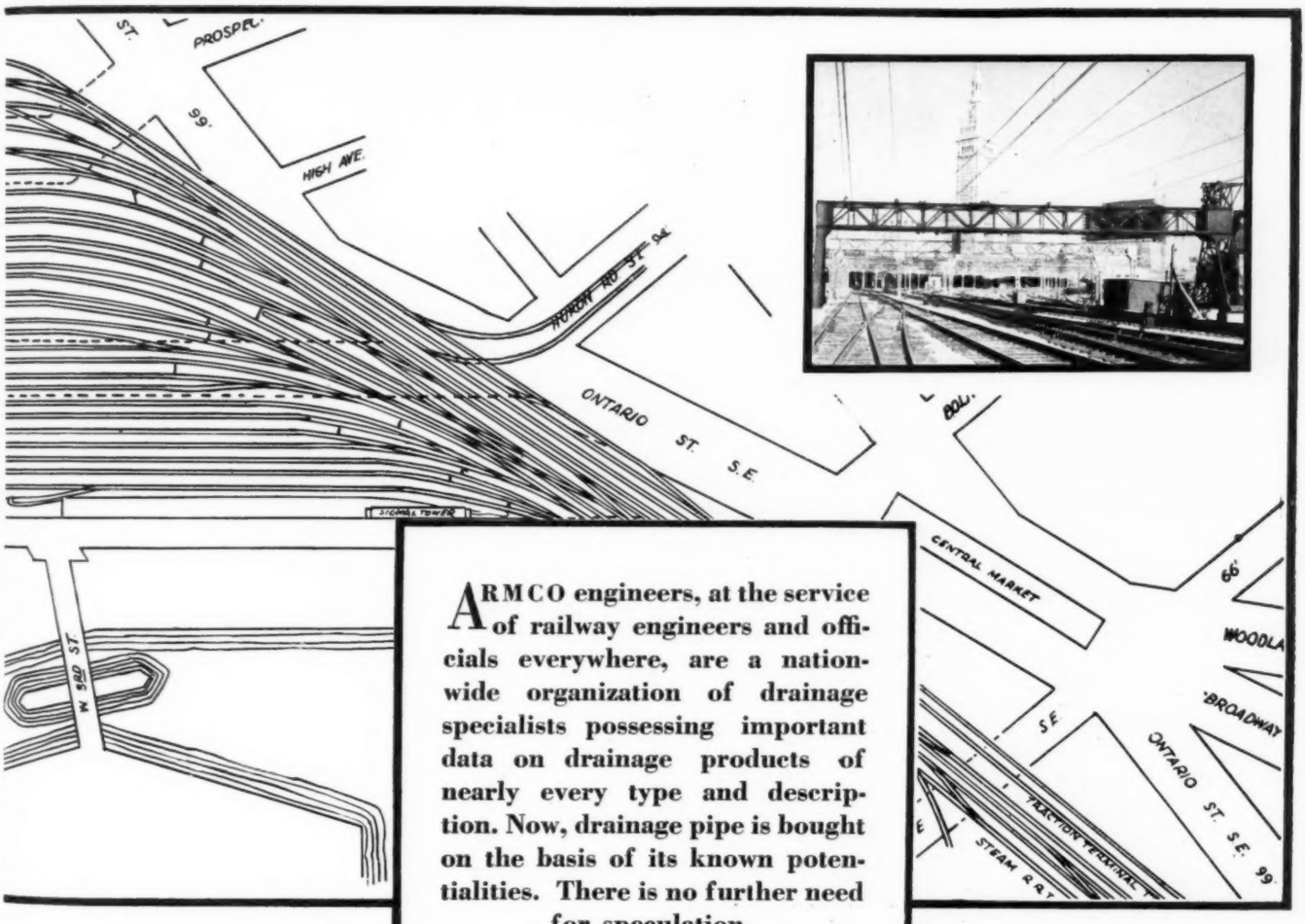
Other Sales Offices: Atlanta Baltimore Birmingham Boston Buffalo Cincinnati Cleveland Dallas Denver Detroit Kansas City Memphis Milwaukee Minneapolis-St. Paul Oklahoma City Philadelphia Pittsburgh Salt Lake City St. Louis Wilkes-Barre Worcester

U. S. Steel Products Co.: San Francisco Los Angeles Portland Seattle Honolulu

Export Distributors: United States Steel Products Co., 30 Church St., New York City

# of Endurance!

DRAINS



ARMCO engineers, at the service of railway engineers and officials everywhere, are a nation-wide organization of drainage specialists possessing important data on drainage products of nearly every type and description. Now, drainage pipe is bought on the basis of its known potentialities. There is no further need for speculation.

ARMCO

ARMCO CULVERT MANUFACTURERS ASSOCIATION

Middletown, Ohio

The Track Special Work

within the entire Terminal Area

consisting of turnouts complete with connecting rails, slip switches, crossings, double crossovers, and guard rails was furnished by us.

New York Central standards were followed generally.

The rail used was 127 lb. Dudley section medium manganese.

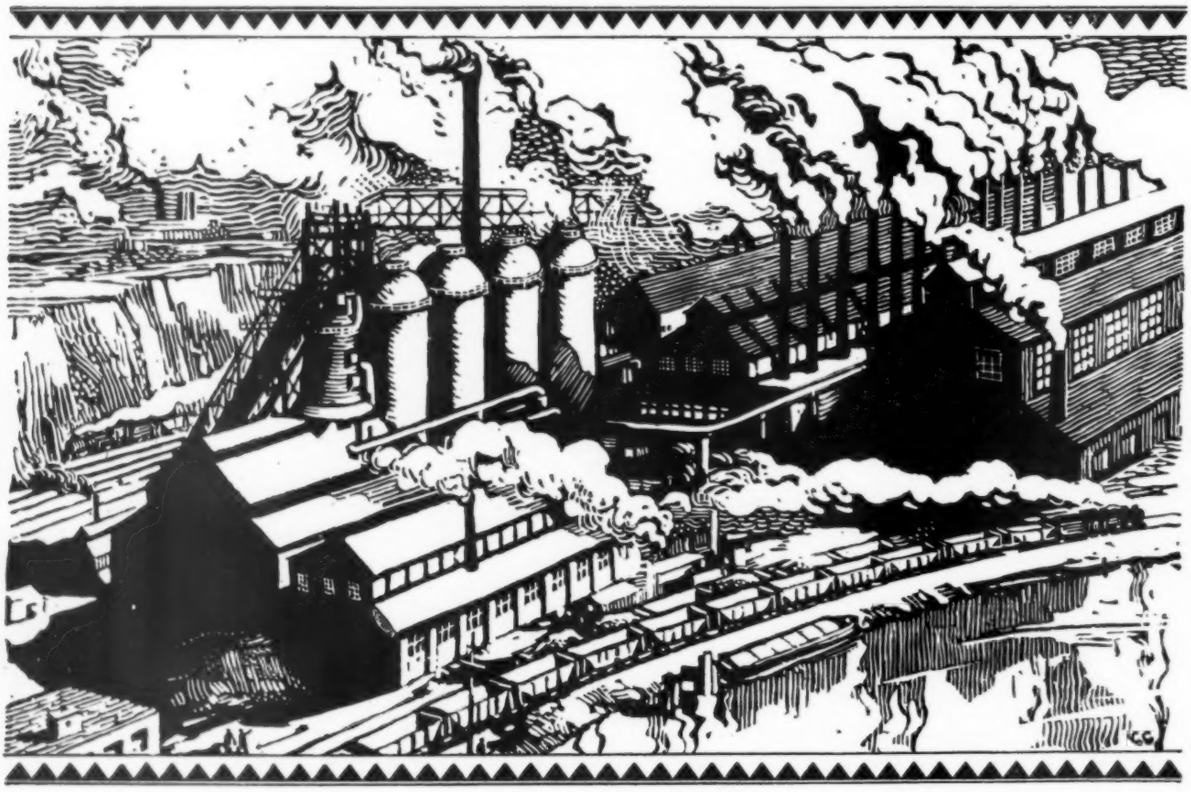
The switches specified were 16½ ft., 22 ft., and 30 ft. The deflecting rail in each was equipped with a manganese tip.

The frogs were of two types: rail bound manganese for high speed points; self guarded solid manganese for slow speed points. Number 8s, 10s, 12s, and 16s only were called for.

CLEVELAND
FROG & CROSSING CO.
6917 Bessemer Ave. Cleveland, O.

STEEL

FOR TOMORROW'S INDUSTRIES



WHEN several leading steel producers united to form the new $335,000,000 Republic Steel Corporation, a closely knit and highly efficient organization was created . . . destined to bring far-reaching benefits to the public, to industry at large and to the railroads who have been served by those companies that are now united.

Under the new centralized control, all activities, from the procurement of raw materials to the delivery of the finished product, are being greatly simplified. A more scientific operation of the plants and a more advantageous allocation of tonnage will result in lower operating costs.

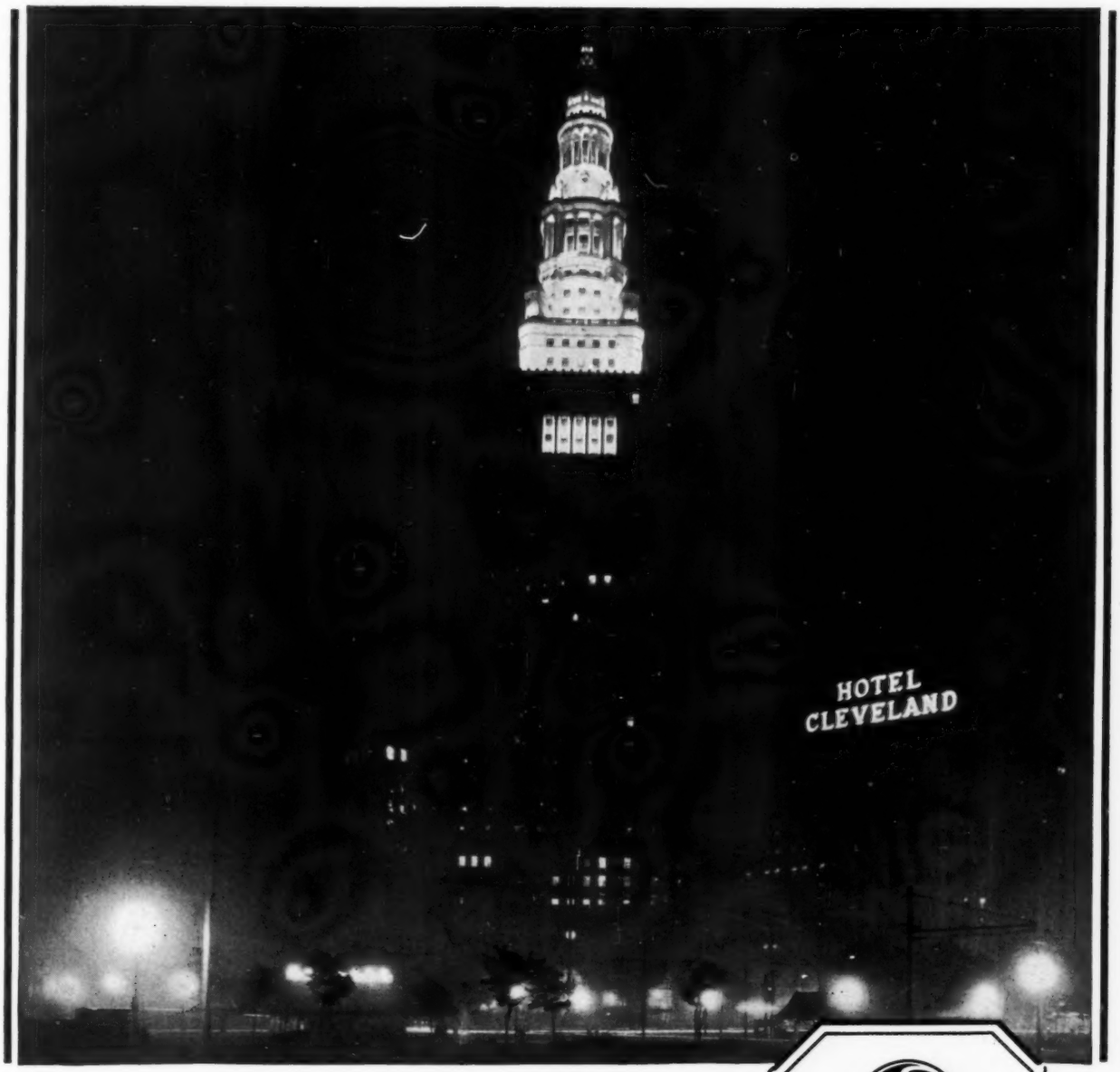
The consolidation has made possible the creation of a highly specialized metallurgical research division to foster the development of new steels, and new uses for steel. The constant aim will be toward greater values and improved products.

The Republic Steel Corporation, standing at the threshold of a new age in steel, is looking beyond today . . . building for the requirements of tomorrow's industries.

Carbon and Alloy Steels ∽ Pipe and Tubular Products ∽ Plates ∽ Bars and Shapes ∽ Hot and Cold Rolled Strip ∽ Black, Blue Annealed and Galvanized Sheets ∽ Special Finish Sheets ∽ Tin Plate ∽ Toncan Iron ∽ Stainless Steel Nuts, Bolts, Rivets, Etc. ∽ Die-Rolled Products

REPUBLIC STEEL
CORPORATION
Headquarters: Youngstown, Ohio

GENERAL ELECTRIC FLOODLIGHTS ILLUMINATE THE TOWER



CLEVELAND'S crown of light—the illuminated Terminal Tower—rises 708 feet above the concourse level of the new Union Station; it is a far-seen symbol of progress and municipal distinction.

This striking and artistic effect is obtained by 239 General Electric floodlighting units. To the selection and arrangement of this equipment, lighting specialists of the General Electric Company contributed their wide experience and all the resources of the G-E Illuminating Engineering Laboratory.

GENERAL ELECTRIC

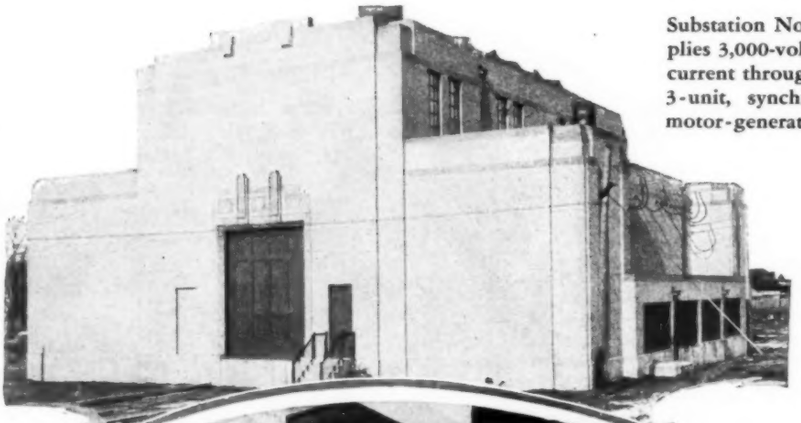
710-85

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

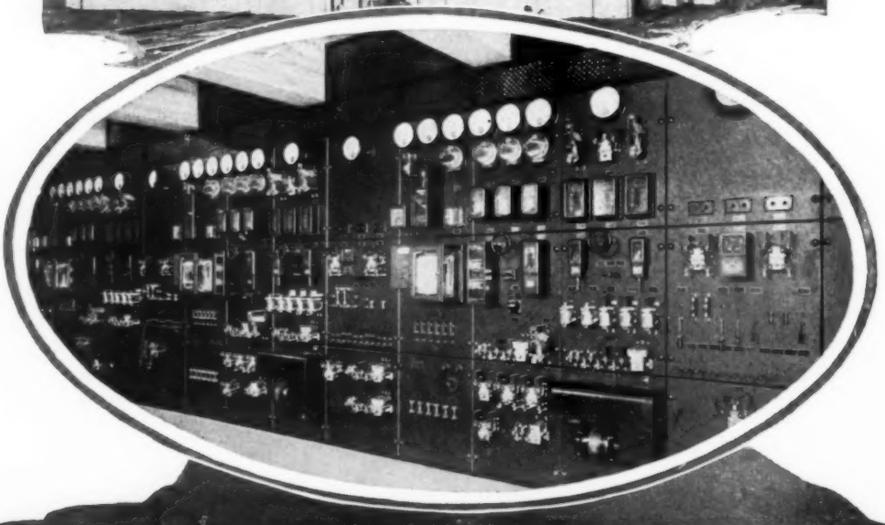
LOCOMOTIVES THE TRAINS

GENERAL ELECTRIC ... SUPPLY

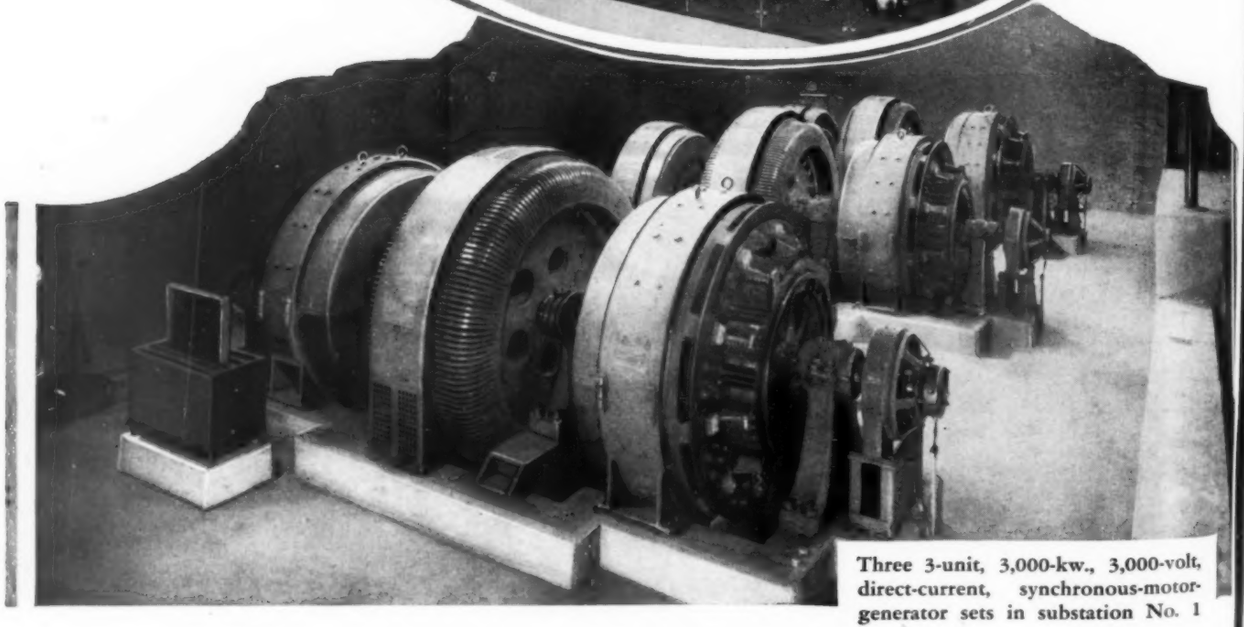
GENERAL ELECTRIC



Substation No. 1 supplies 3,000-volt direct current through three 3-unit, synchronous-motor-generator sets



Automatic control panels for the synchronous-motor-generator sets in substation No. 1



Three 3-unit, 3,000-kw., 3,000-volt, direct-current, synchronous-motor-generator sets in substation No. 1

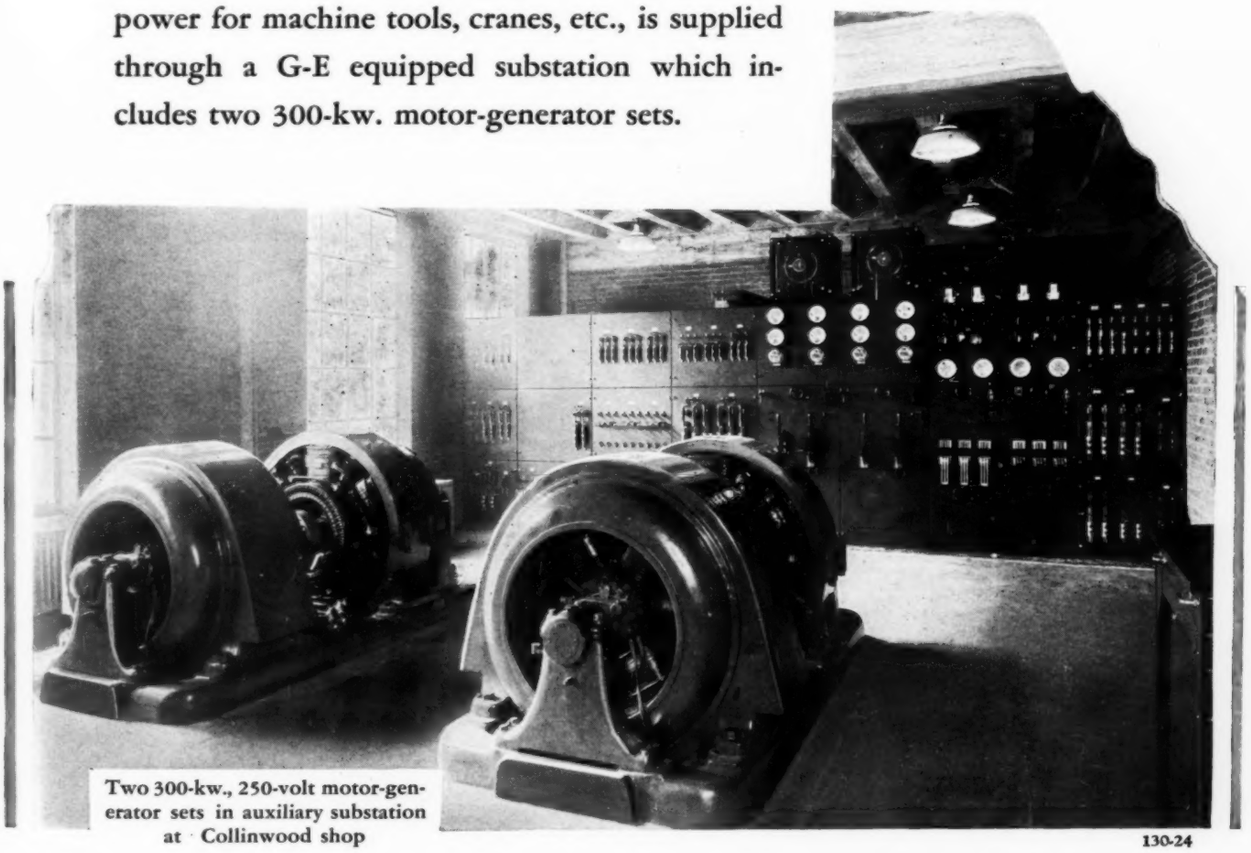
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

SUBSTATIONS THE POWER

GENERAL ELECTRIC

POWER for the Cleveland electrification is purchased from the Cleveland Electric Illuminating Company (11,000 volts, 3-phase, 60 cycles) and supplied through two G-E automatic substations. Substation No. 1, located 3½ miles west of the terminal, includes three 3,000-kw. units; substation No. 2, located 7½ miles east of the terminal, includes two 3,000-kw. units. The substation equipment and feeders are protected by G-E high-speed circuit breakers installed in the substations and in six circuit-breaker houses.

At the Collinwood maintenance shop, auxiliary power for machine tools, cranes, etc., is supplied through a G-E equipped substation which includes two 300-kw. motor-generator sets.



Two 300-kw., 250-volt motor-generator sets in auxiliary substation at Collinwood shop

130-24

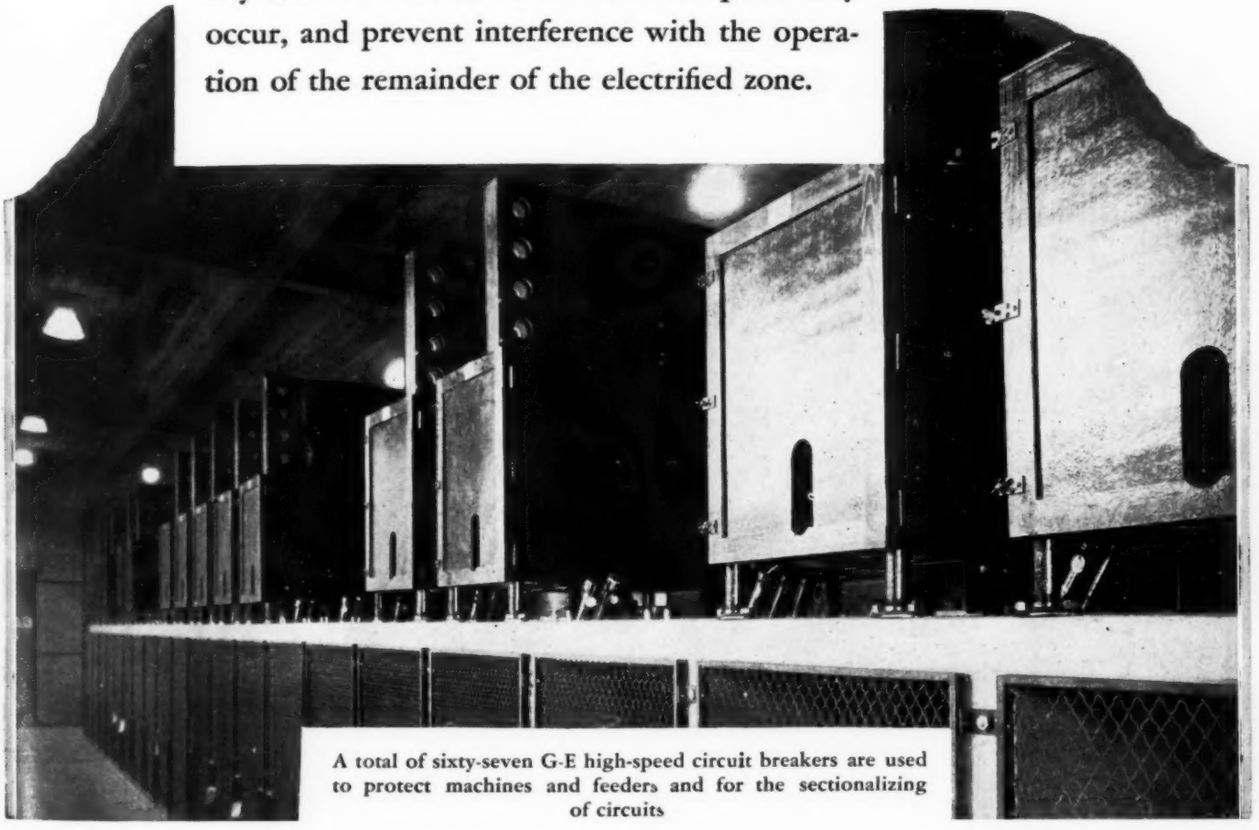
SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

SWITCHGEAR THE POWER

GENERAL ELECTRIC

COMPLETE control of the power is centered in the dispatcher's office at the Terminal Building by means of G-E supervisory equipment. The operator has constant visual indication and control of the operation of the supply lines to the substations, the starting and stopping of the substation machines, the opening and closing of all feeders (both in the substations and in six circuit-breaker houses), and all auxiliary equipment.

The power dispatcher is thus enabled to isolate any section of track where an interruption may occur, and prevent interference with the operation of the remainder of the electrified zone.



A total of sixty-seven G-E high-speed circuit breakers are used to protect machines and feeders and for the sectionalizing of circuits

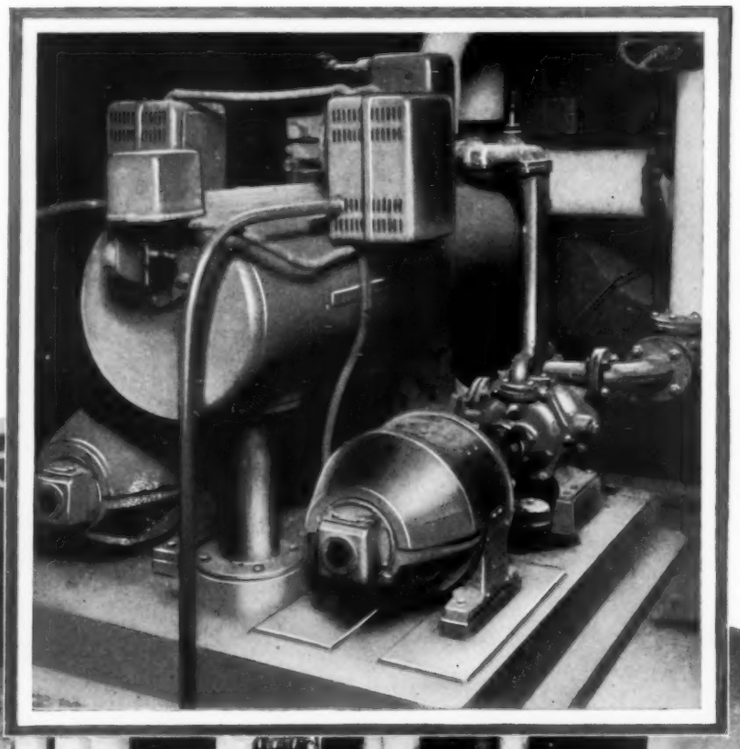
460-47

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

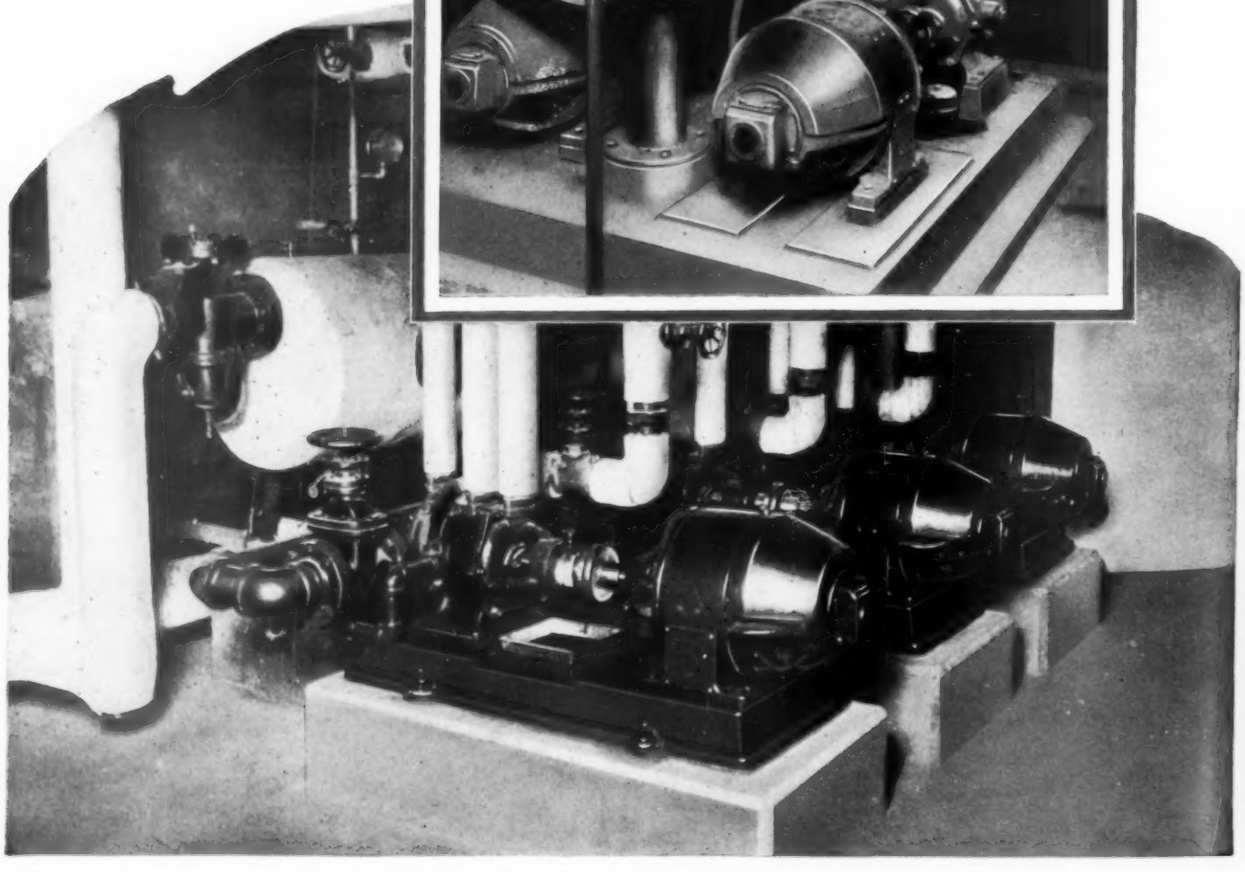
GENERAL ELECTRIC

PUMPS—FANS—

GENERAL ELECTRIC



Two G-E 7.5-hp. motors operating centrifugal-type vacuum heating pumps in the terminal building



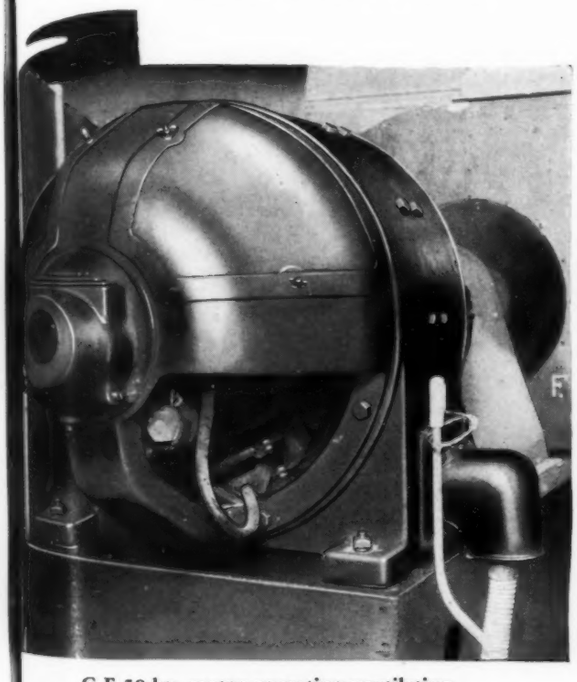
Three G-E 3-hp. motors operating centrifugal-type vacuum heating pumps in the terminal building

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

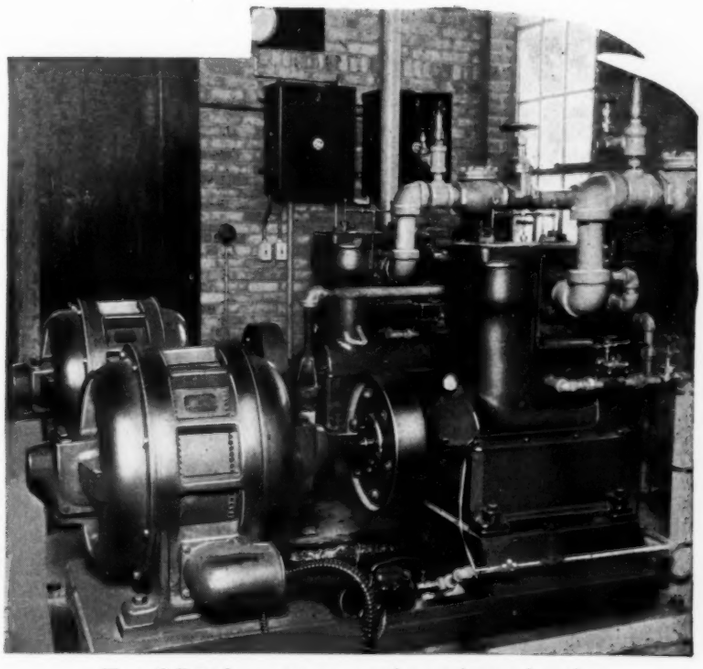
MOTORS DRIVE COMPRESSORS

GENERAL ELECTRIC

THE extraordinary air-conditioning system of the Union Station building proper, with its automatic temperature control, represents great progress in public-health engineering. Fifty-six large motor-driven fans are used to change a total of 1,500,000 cubic feet of air per minute. General Electric motors and control are in a large measure responsible for the economical operation of the system. G-E motors are also used to drive various pumps for the water and steam heating systems.



G-E 50-hp. motor operating ventilating fan in the terminal building

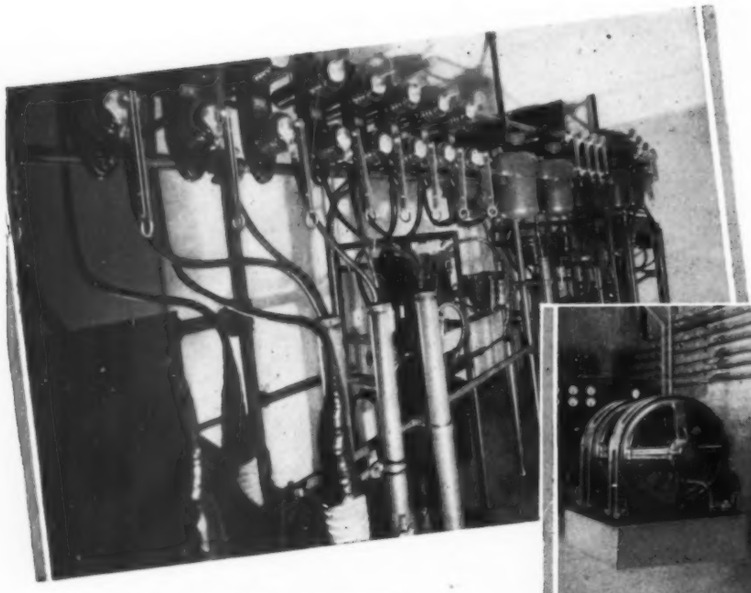


Two G-E 25-hp. motors operating reciprocating air compressors at the Collinwood inspection shed

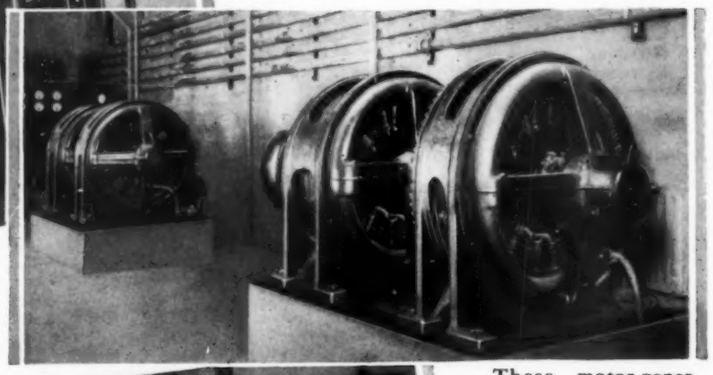
200-381

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

GENERAL ELECTRIC SIGNAL POWER SAFEGUARDS THE TRAFFIC



High-voltage switching equipment used in connection with the automatic switchboard at the terminal



These motor-generator sets provide all the signal power for the electrified zone

Continuous signal power is provided through this switchboard at the terminal, which operates in connection with the automatic stations at Collinwood and Linndale

THROUGHOUT the Cleveland Union Terminal electrified zone, the operation of signals and, hence, the safety of traffic depend upon General Electric signal-power equipment. The automatic control apparatus installed just south of the Union Station and at Linndale and Collinwood, the limits of the electrified zone, provides continuous supply of energy for all signal functions.

Join us in the General Electric Hour, broadcast every Saturday evening on a nation-wide N.B.C. network

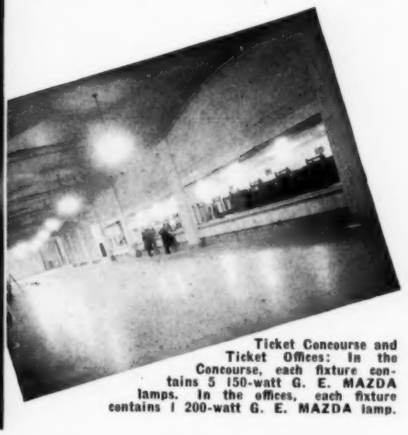
GENERAL ELECTRIC

460-46

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

Platform: R L M Domes, 150-watt G. E. MAZDA lamps; height, 15 feet; spacing, 21 feet.

Lighted by NATIONAL from Tower Top to Basement



Ticket Concourse and Ticket Offices: In the Concourse, each fixture contains 5 150-watt G. E. MAZDA lamps. In the offices, each fixture contains 1 200-watt G. E. MAZDA lamp.

Concourse: 10 fixtures, each containing 121 40-watt white G. E. MAZDA lamps.

THE Cleveland Union Terminal buildings and the new Union Station are equipped throughout with General Electric MAZDA lamps. National Lamp Works lighting engineers assisted the architects and builders in the lighting specifications.

The attractive floodlighted tower distinguishes the Terminal Building as the show place of Cleveland, and extends a cordial welcome to all travelers in Cleveland.

The lighting throughout is in accordance with approved modern lighting standards, which require higher intensities of illumination, skilfully employed.

Improved illumination for all railroad operations is a sound investment. The difference in cost of installation and maintenance between poor and good lighting systems is almost negligible, especially when the low cost of current and lamps is considered.

The facilities of the Engineering Department, Nela Park, Cleveland, Ohio, are at your disposal, without obligation. Let our engineers assist in solving your lighting problems. Address the National Lamp Works of General Electric Company, Nela Park, Cleveland, Ohio.

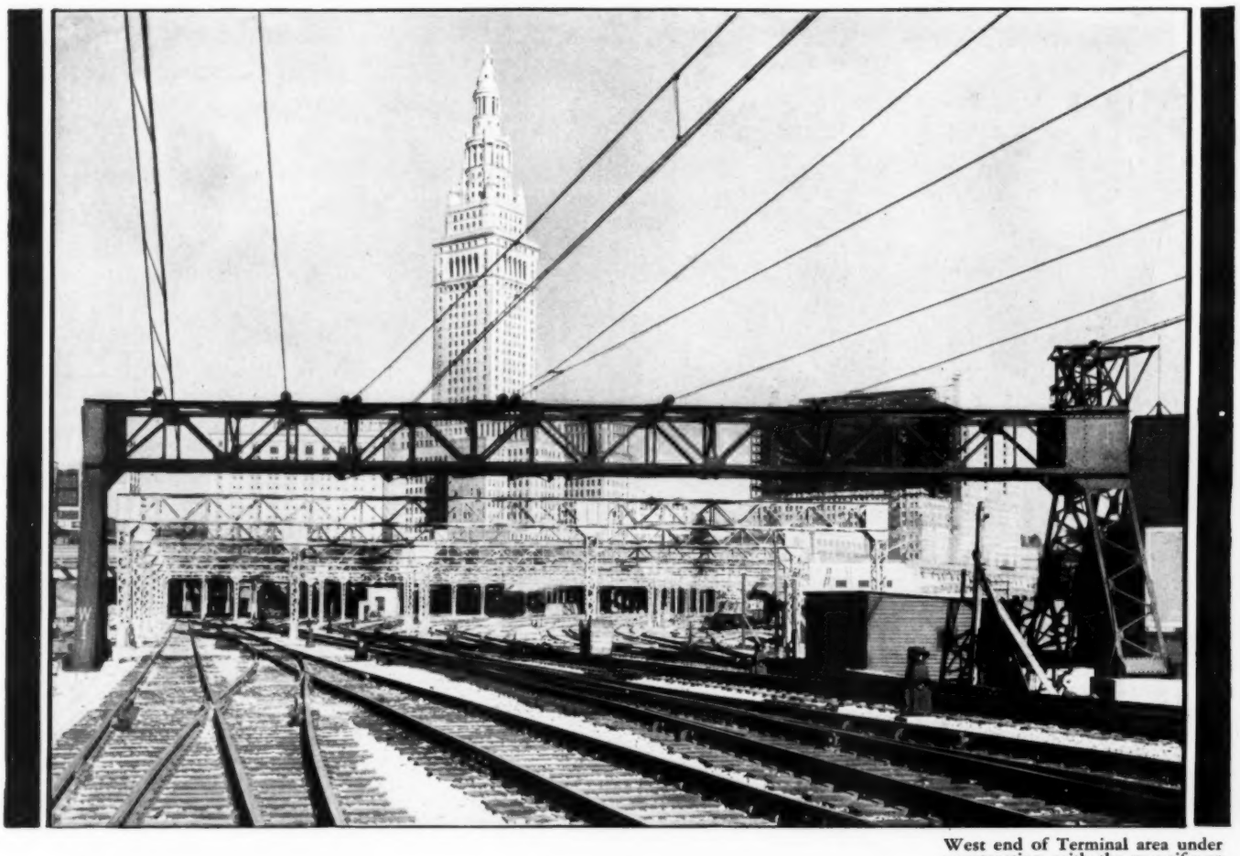
Collinwood Engine House: High Bay Mounting Units with 300- and 500-watt G. E. MAZDA lamps.

Coach Storage Yard: G. E. Refractor Units with 300-watt white bowl G. E. MAZDA lamps.

Join us in the General Electric program, broadcast every Saturday evening over a nation-wide N. B. C. network.

GENERAL ELECTRIC

MAZDA LAMPS



West end of Terminal area under construction, with the magnificent Terminal Tower in the background.

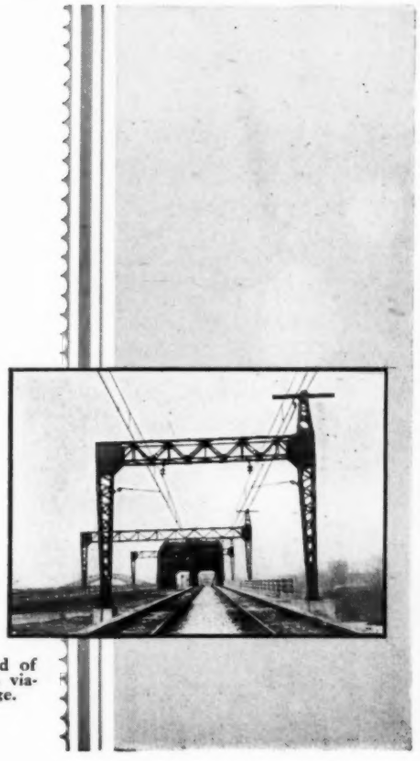
TERMINAL ELECTRIFICATION

(2 in parallel) having a minimum conductivity of 55% I. A. C. S. and meeting all physical requirements of A. S. T. M. specifications for high-strength bronze.

4. Auxiliary—secondary messenger, consisting of 19 strands 4/0 hard-drawn copper cable; outside diameter, .528 in.; breaking strength, 9,600 lbs.

Anaconda engineers cooperated in the design of the catenary system for this most involved installation of its kind in the world. A number of unalterable conditions added to the complexities of the engineering problem which Cleveland Union Terminal engineers solved so successfully, among them an excessive number of curves and very little tangent track, close clearances, wind and sleet loads, 300-ft. average spans, and a permissible vertical movement of only two feet for the main messenger cable.

Thus Anaconda continues its record of having supplied wire and cable products and contributed engineering service for every outstanding railway electrification project in this country.



West end of Cuyahoga viaduct bridge.

& CABLE COMPANY

Chicago Office: 111 West Washington Street

Principal Cities

BUILDING *for the* FUTURE

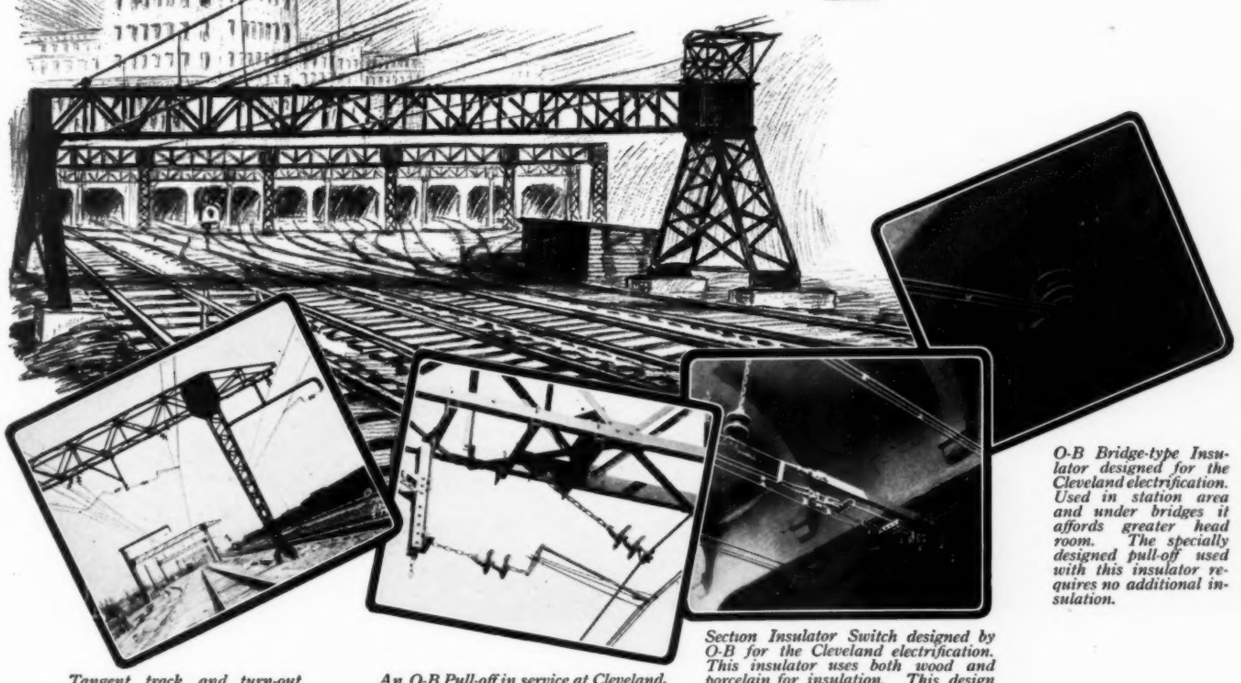
THE 100 million dollar Cleveland Union Terminal project evidences, in a splendidly substantial way, the faith which three of the country's large railroads have in the future growth of Cleveland.

The successful completion of so great an engineering undertaking required unusual foresight and engineering skill. And the manner in which the many complex problems were solved, will long stand as a tribute to the engineers whose tireless work made this improvement a reality.

In the selection of electrification materials, these engineers have built for the future too. The materials used were tested and selected with the thought of future dependability ever in mind. So O-B catenary fittings were used exclusively throughout, and thousands of O-B porcelain insulators are in service. Not only is O-B associated with the Cleveland Terminal electrification, but the products of this well-known company are to be found on most electrifications.

In building for the future, men who will some day apply the benefits of electrification to other transportation projects may well record O-B as being a desireable source of supply; because designing and manufacturing the insulation, suspension, and bonding materials for steam road electrifications is the work to which O-B brings to bear a rich background of experience as well as outstanding engineering and manufacturing talent.

Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co. Limited
Niagara Falls, Canada
1235LH



Tangent track and turn-out construction using O-B Hangers, Clips, and Pull-offs.

An O-B Pull-off in service at Cleveland. Flexibility and great strength to withstand side pulls are characteristics of this O-B Catenary device.

Section Insulator Switch designed by O-B for the Cleveland electrification. This insulator uses both wood and porcelain for insulation. This design affords a large factor of safety in insulation qualities and develops a very high ultimate of mechanical strength.

O-B Bridge-type Insulator designed for the Cleveland electrification. Used in station area and under bridges it affords greater head room. The specially designed pull-off used with this insulator requires no additional insulation.

Ohio Brass Co.

NEW YORK PITTSBURGH CHICAGO CLEVELAND ST. LOUIS ATLANTA DALLAS
PHILADELPHIA BOSTON LOS ANGELES SAN FRANCISCO SEATTLE

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES

A NOTABLE INSTALLATION ROME-WIRED

Cleveland Union Terminal is one of America's great railroad projects come to fulfillment.

Extreme reliability of every adjunct of its complex signal system is imperative. Therefore, great significance attaches to the fact that all the Parkway, and all lead-covered cables for signal control were supplied by the Rome Wire Company Division of General Cable Corporation, Rome, New York.

ROME WIRE COMPANY DIVISION
OF
GENERAL CABLE CORPORATION

Cleveland Union Terminal

The Cleveland Union Terminal, located in the heart of a great city, conceived with the idea of serving as the passenger station for every railroad entering Cleveland, ranks as one of the world's greatest terminal projects.

Here is being provided every facility which the inventive genius of man has created for comfort, speed and efficiency in the interchange and handling of passengers who travel by rail.

The project is planned for ultimately improving the air rights above the entire terminal area, which necessitates the most intensive use of track facilities.

G-R-S All-Electric Interlocking

was selected as the system best suited to the present and future needs of this terminal.

G-R-S ALL-ELECTRIC INTERLOCKING

Provides the Last Word in the Control of Track and Signal Facilities at Cleveland

IN the installation of the interlocking system, a number of departures have been made from interlocking practices of the past for the purpose of simplifying and speeding up operation as well as maintenance of the switch and signal equipment in the new Cleveland Union Terminal.

Lock rods have been eliminated from all switch machines. This was made possible and practical due to the fact that all G-R-S Switch Machines lock the throw-bar and in addition because of the highly efficient built-in point detector provided in the Model 5A Switch Machine.

Indication magnets are eliminated from all levers in the interlocking machine, permitting the levers to be operated to full stroke without waiting for the indication. This materially speeds up and simplifies manipulation of levers. Dynamic indication features are retained. Transit-light indicators above the lever inform the operator that the controlled function is responding to the lever movement. The signal governing over the route will not indicate proceed unless all switches in the route are in proper position and locked.

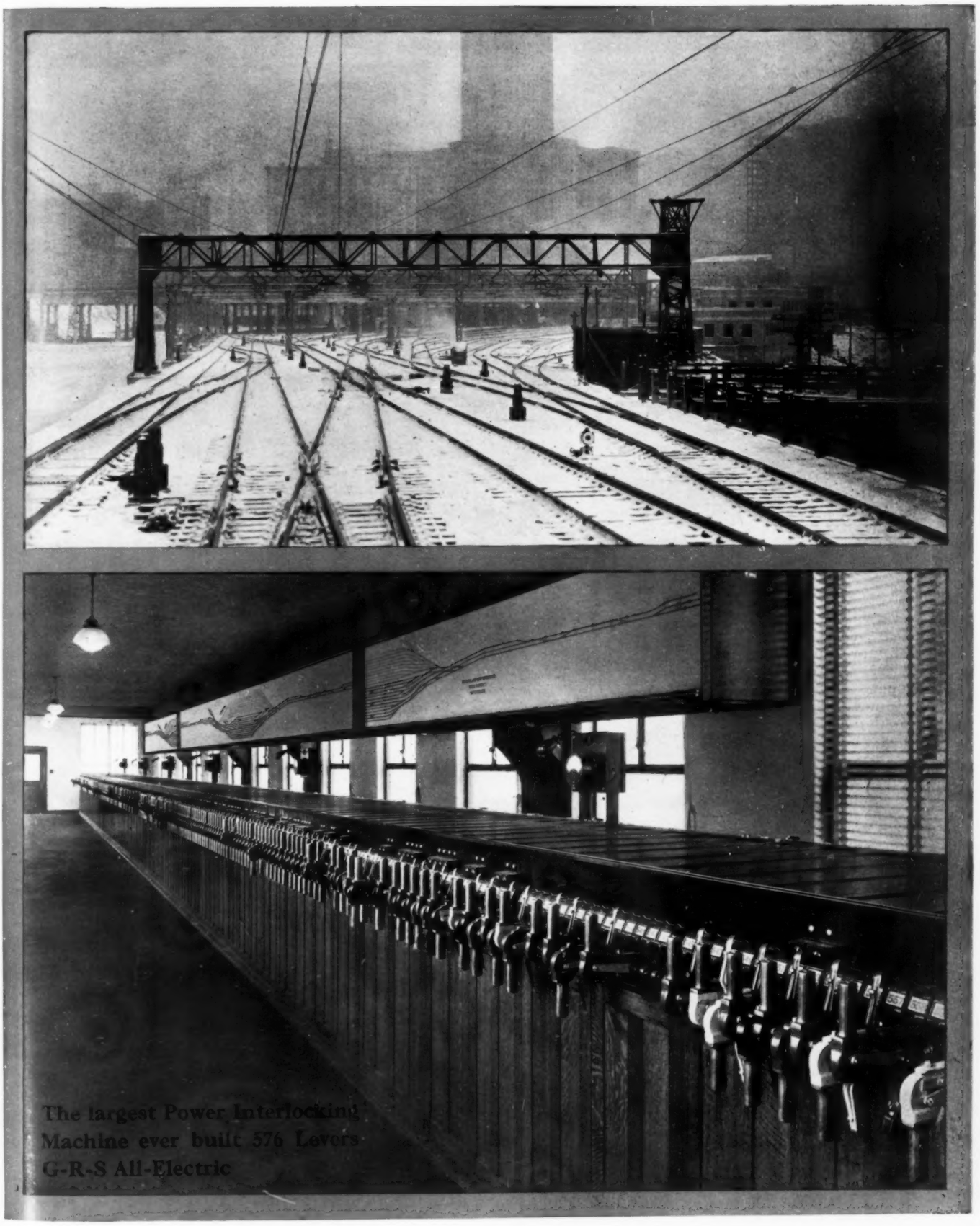
All relays, both track and line for the entire terminal area, are located in the signal station below the interlocking machine, which greatly facilitates maintenance.

All switch machines are operated directly through contacts on interlocking machine levers from a central battery in the signal station. Switches located 8000 feet from the interlocking machine are being operated in 2½ to 3½ seconds under severe winter conditions.

The use of *G-R-S All-Electric Interlocking* at Cleveland Union Terminal is a striking example of its flexibility and adaptability to present and future conditions as they are viewed by highly skilled terminal engineers.

If you are contemplating the installation of an interlocking plant, large or small, it will pay you to make a full investigation of the latest developments as employed at Cleveland. We shall be glad to furnish further information.

GENERAL RAILWAY SIGNAL COMPANY



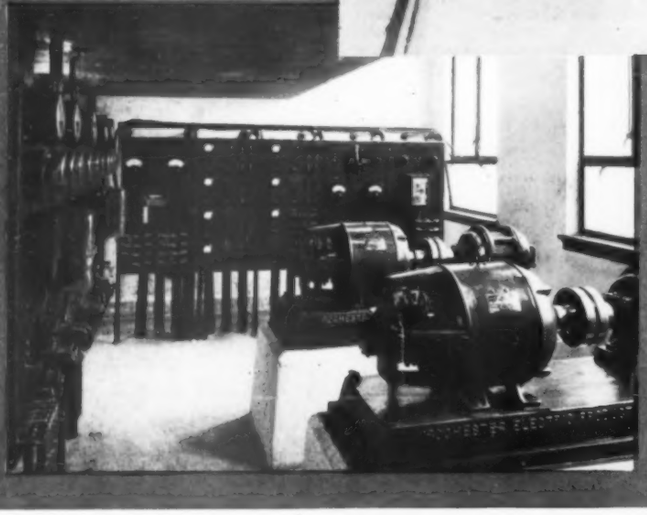
The largest Power Interlocking Machine ever built 576 Levers G-R-S All-Electric

Upper Left. Type SA Dwarf Signals provide simple Aspects.

Center. Type SA Color Light Signals suspended from catenary bridge. Note the large amount of clearance the use of these signals provides.

Upper Right. A Double Slip Switch. Note the simplicity of the layout due to the absence of lock rods.

Lower Left. Switchboard and Motor Generator room. There is only a small amount of power equipment required with the All-Electric System.



Lower Right. 240 Ampere Hour Storage Batteries provide ample reserve power.

A787

GENERAL RAILWAY SIGNAL COMPANY

ROCHESTER, N. Y.

NEW YORK CHICAGO ST. LOUIS MONTREAL LONDON PARIS BARCELONA MELBOURNE

Electric Messenger Service

of Cleveland Terminal gets train announcements and coach movement orders to proper persons in typewritten form at lightning speed!

Thanks to Teletype . . . the Telegraphing Typewriter . . . train announcements and coach movement orders at the Cleveland Union Terminal are handled with amazing speed and accuracy.

One of these telegraphing typewriters is located at the Telegraph Office. Another is located at the Signal Tower. Both are connected with receiving machines at the Bulletin Board, Information Booth, Telephone Information, Ticket Office, Pullman Reservation, Baggage Room, Mail Room and six other important points.

The Teletype at the Telegraph Office is used for sending out advance information regarding train arrivals; for example, "TRAIN NO. 9 ONE HOUR LATE". That at the Signal Tower is used for giving the track number on which a train will arrive; for instance, "TRAIN NO. 11 ON TRACK 15". All receiving machines receive the same message at the same time . . . clearly printed in typewriter type that makes misunderstandings impossible.

Teletype also is used for sending coach movement orders from the Telegraph Office to the West End Yardmaster, East End Yardmaster, Car Department Foreman, Sub-Foreman, Crew-Dispatcher and Station Master. An operator at the Telegraph Office types "ADD ONE COACH TO TRAIN NO. 7," for example, and instantly the message is reproduced at each of the above points.

The advantages of this Teletype installation to the Cleveland Union Terminal are: (1) Information is transmitted at high speed to many points *simultaneously*. (2) Messages are printed in legible type, thus eliminating mistakes. (3) Operators are unnecessary at receiving machines as they record messages automatically.

Isn't it possible that a Teletype installation would improve the efficiency of *your* terminal? The coupon below brings full information . . . clip and mail it *now!*

TELETYPE

THE TELEGRAPHING TYPEWRITER

MAIL FOR FURTHER FACTS

TELETYPE CORPORATION
1400 Wrightwood Ave., Chicago

Without cost or obligation, please send me further information regarding Teletype and its cost.

*Name*_____

*Position*_____ Ry. Age 6-28-30

$150,000,000 CLEVELAND

NIGHT AND DAY *Exide Batteries stand ready to do their many varied jobs for the great new Union Terminal at Cleveland, Ohio. These two views show the beauty and size of this $150,000,000 terminal.*

THIS TRACTOR, *powered by an Exide-Ironclad Battery, is one of the Union Terminal's fleet of trucks and tractors used to speed handling of baggage.*

* * *

IN CIRCUIT BREAKER HOUSE NO. 3, *you'll find this 60-cell Exide Chloride operating battery and 60-cell supervisory battery. They're always on the job.*

EXPRESS trains roar in. Other crack trains move out. Baggage is whirled speedily in every direction. Passengers board cars, alight, go to and fro. Trunks . . . express . . . mail. The great new Union Terminal at Cleveland, Ohio, is virtually a beehive of activity.

Activity, yes. But smooth-running, efficient activity. Day-in, day-out, the equipment of this terminal, with its maze of tracks and heavy traffic, must function steadily, dependably, economically.

That's why Exide Batteries were selected for so many purposes. 119 switches are operated by Exides. The largest interlocking machine ever constructed in one frame depends on Exides. The closing and tripping of all D. C. feeder breakers and all A. C. incoming line breakers rely on power from Exide Batteries.

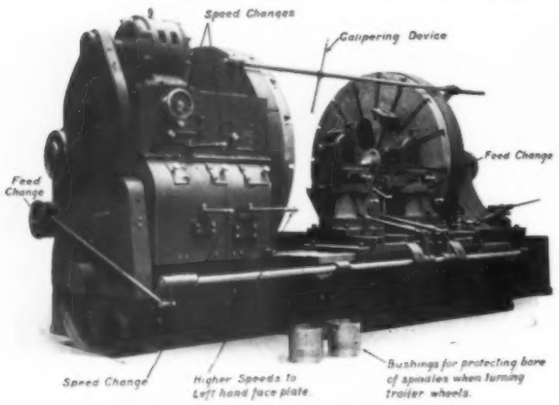
And that's not all. There are other applications. Exide Chloride

THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

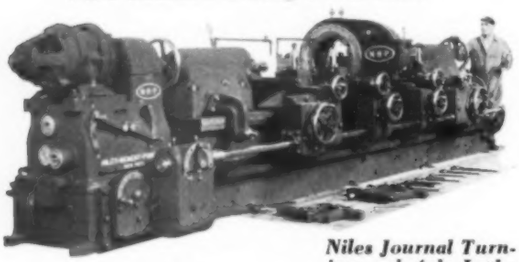
NILES

NILES TOOLS

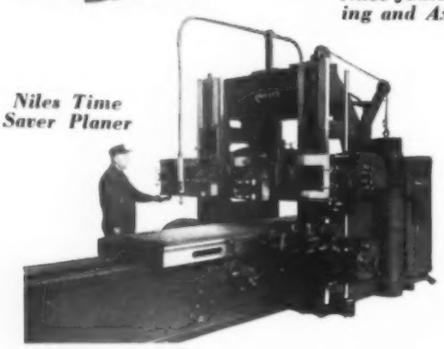
For the ELECTRIC Locomotive Shops



Niles Standard Driving Wheel Lathe



Niles Journal Turning and Axle Lathe

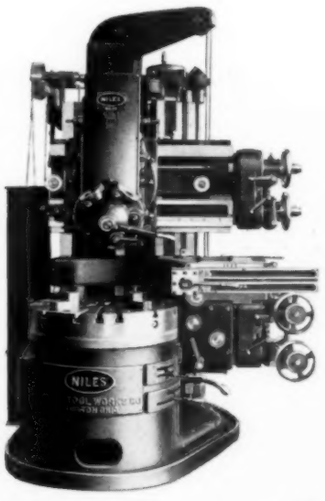


Niles Time Saver Planer

Niles Time Saver Lathe

THE operating economy of Niles tools contain no negative quality. They are always a producing force in railroad shops, and emergencies serve only to emphasize their value.

The Cleveland Union Terminals Company selected Niles because they have kept pace with the steady advance made by the railroads, and the intimate knowledge of every requirement, Niles tools combine maximum utility at lower cost. When you get the facts you will get a Niles.



Niles Sidehead Boring Mill

The Niles Tool Works Company, Hamilton, Ohio

Division General Machinery Corporation of Delaware

SALES OFFICES

NEW YORK
454 New York Central Bldg.
PITTSBURGH
1723 Grant Bldg.
DETROIT
227 Curtis Bldg.
CHICAGO
1853 Daily News Bldg.
FOREIGN DEPT.—Niles Bement Pond Co.,
111 Broadway, N. Y.

SELLING AGENTS

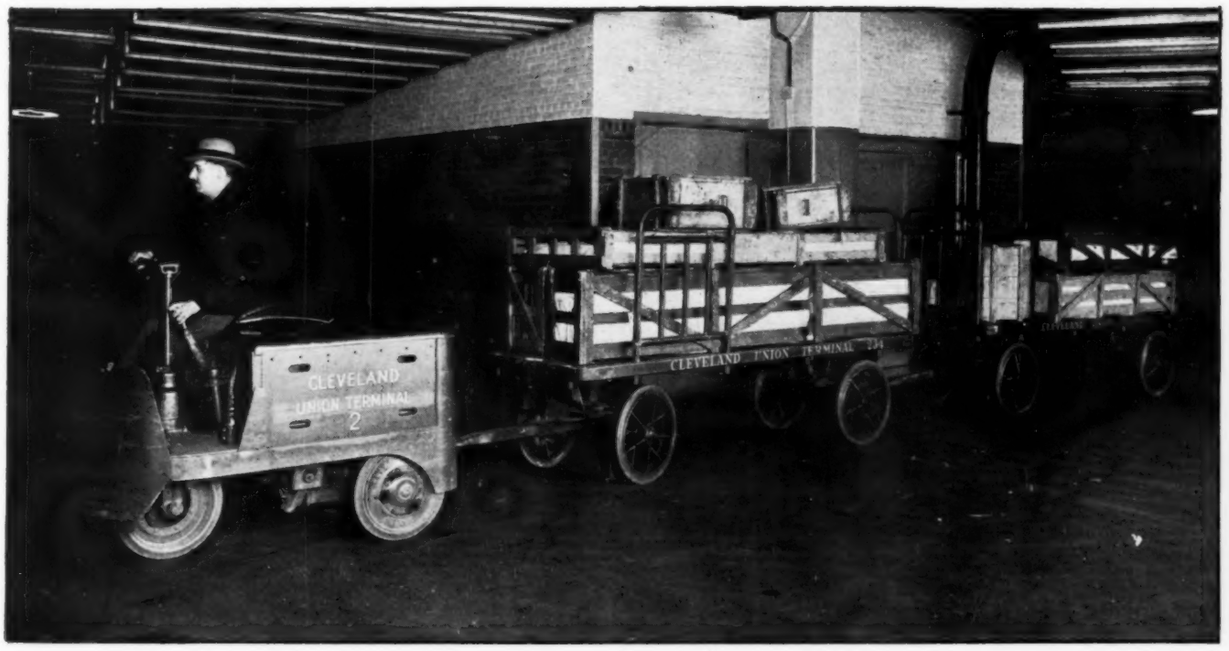
BULOTTI MACHINE CO.,
San Francisco, Cal.
HALLIDIE MACHINE CORP.,
Seattle, Wash.
MAIR MACHINE CORP.,
Houston, Dallas, Texas
PRATT and WHITNEY CO.
Birmingham, Ala.
PRATT and WHITNEY CO.,
Los Angeles, Cal

Baker

TRUCKS AND TRACTORS

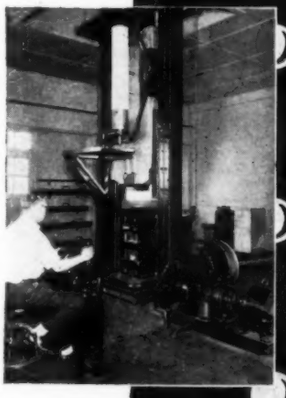
exclusively were chosen by engineers of The Cleveland Union Terminals Co. and The Railway Express Agency, Inc. . . . . Separate investigations by each company led to the same conclusion . . . . . BAKER superiority of design and dependability in exacting service.

BAKER INDUSTRIAL TRUCK DIVISION of The Baker-Raulang Co., Cleveland, O.



BUILT TO SELF-IMPOSED STANDARDS!

Waugh Spring Plate Friction Draft Gear



Drop Hammer, Waugh Testing Laboratories

SEVEN years ago we started to make the best possible draft gear for passenger and freight equipment.

Our first step was a complete testing and research laboratory - the best that money could buy.

We knew what a draft gear ought to do and built to these standards.

Waugh Draft Gears are the result of this searching test and of painstaking development.

140,833 Waugh Gould Draft Gears are giving satisfactory, successful, economical service.

Our laboratory can help solve your draft gear problems.

WAUGH EQUIPMENT COMPANY

Graybar Building
420 Lexington Ave.
New York

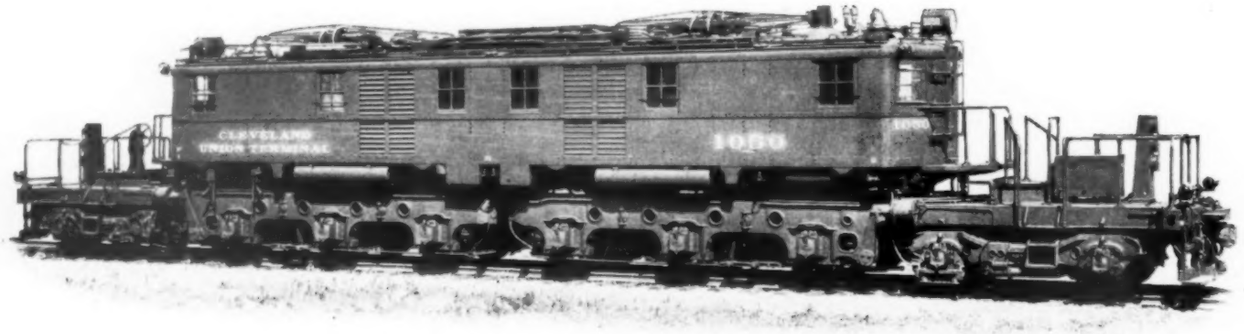
Peoples Gas Building
122 Michigan Ave.
Chicago

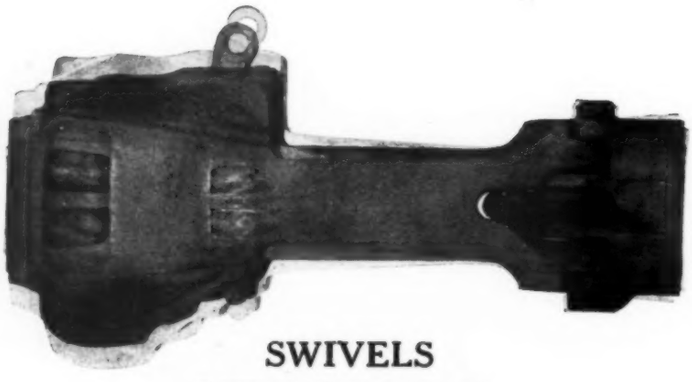
Canadian Waugh Equipment Company, Limited
974 St. Antoine Street
Montreal, Canada

Laboratory and Factory
Office
Depew, New York

Cleveland Terminal Electric Locomotive 100% equipped with Waugh Draft Gears

THE CLEVELAND
LOCOM





SWIVELS
VERTICALLY
ON THE A. R. A. STANDARD DRAFT KEY

THE SYMINGT

Cleveland Office:

New York Chicago Balti
St. Louis Adanac Supplies

UNION TERMINAL
OTIVES

ARE EQUIPPED WITH

SYMINGTON
SWIVEL BUTT COUPLERS

SWIVELS
HORIZONTALLY
ON
ITS OWN PIN

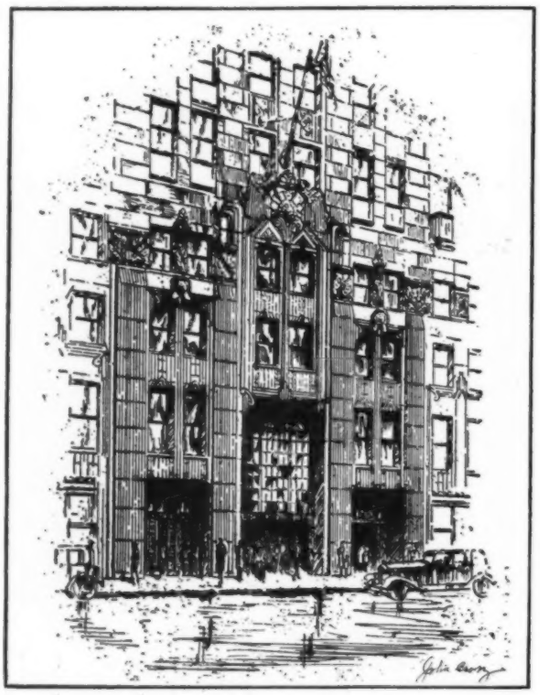
FARLOW
Draft Attachments
and
SYMINGTON
Journal
Box Lids

92,539
In
Service
Or
On Order

ON COMPANY

Terminal Tower Bldg.

more Boston San Francisco
Ltd., Montreal Works: Rochester & Depew



Entrance to the new home of the Midland Bank in the new Midland Bank Building.

Our NEW BANKING HOME is an *Important Unit of the* TERMINAL GROUP

In step with Cleveland's development in transportation and industry, The Midland Bank and Midland Corporation open their new offices in the Terminal Group early in July. The organization and management of this institution, whose directors include men active in railroad affairs, assure a helpful, progressive viewpoint on the financial needs of America's new transportation and industrial center.

THE MIDLAND BANK

MIDLAND CORPORATION

Cleveland

MIDLAND

DIRECTORS

C. L. BRADLEY
Chairman of the Board of The Erie Railroad

ALVA BRADLEY
Real Estate

E. E. BARKER, *Vice-President The Midland Bank*

ELTON HOYT, II, *Partner Pickands, Mather & Company*

JOHN SHERWIN

JOHN SHERWIN, JR., *President The Midland Bank*

G. A. TOMLINSON
President, The Tomlinson Fleet

Cleveland Union Terminals

Contractors and Manufacturers Index

This buyers' reference includes the names of contractors and equipment manufacturers whose services or materials are built into the Cleveland Union Terminals Project.

American Air Filter Co., Inc.—47
Air Filters

American Bridge Co.—68-69-72
Construction Contractors
Fabricated Structural Steel

American Radiator Co.—50
Pipe
Radiators

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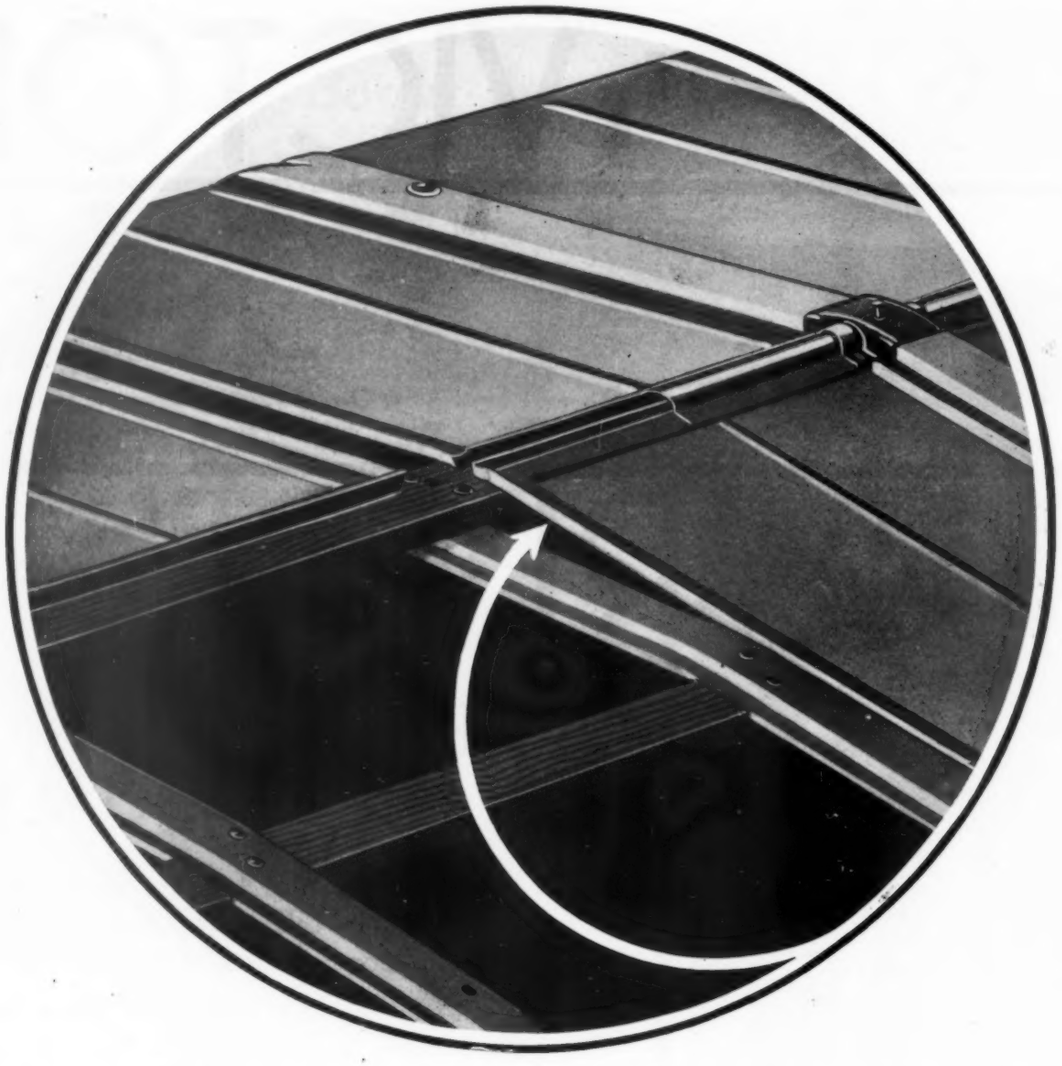


ROOF STRAINS—STEEL vs. WOOD CARS

It goes without saying that more of the shocks and strains on a car body, due to unevenness or curvature of track, and switching are carried as high as the roof on all-steel car than on a wood car.

In a wood frame car, some of these strains are taken up in the superstructure on account of the greater elasticity of wood and the necessarily less rigid construction. In the all-steel car they are carried to the roof.

Which, then, has the greater need of flexibility in the roof to prevent its distortion and the impairment of its weatherproofing qualities?

UNIVERSAL DRY LADING ALL-STEEL ROOFS

provide for the absorption of these strains by the flexibility of their connection with the side plates and of the roof plates with each other.

HUTCHINS CAR ROOFING COMPANY
DETROIT MICHIGAN
Established 1880

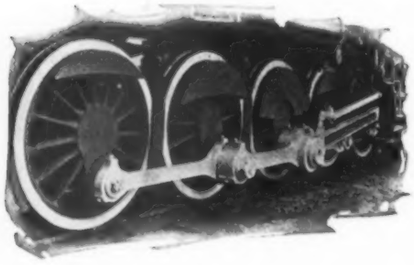
Maintenance is lower with Tandem Main Rod Drive

TWO groups of locomotives, identical except that one group has the Tandem Main Rod Drive, have been running nearly three years.

Locomotives with the Tandem Main Rod Drive are running far longer between shoppings than those not so equipped.

Instead of concentrating heavy thrusts on one set of main pins the Tandem Main Rod Drive distributes it over two axles and four pins.

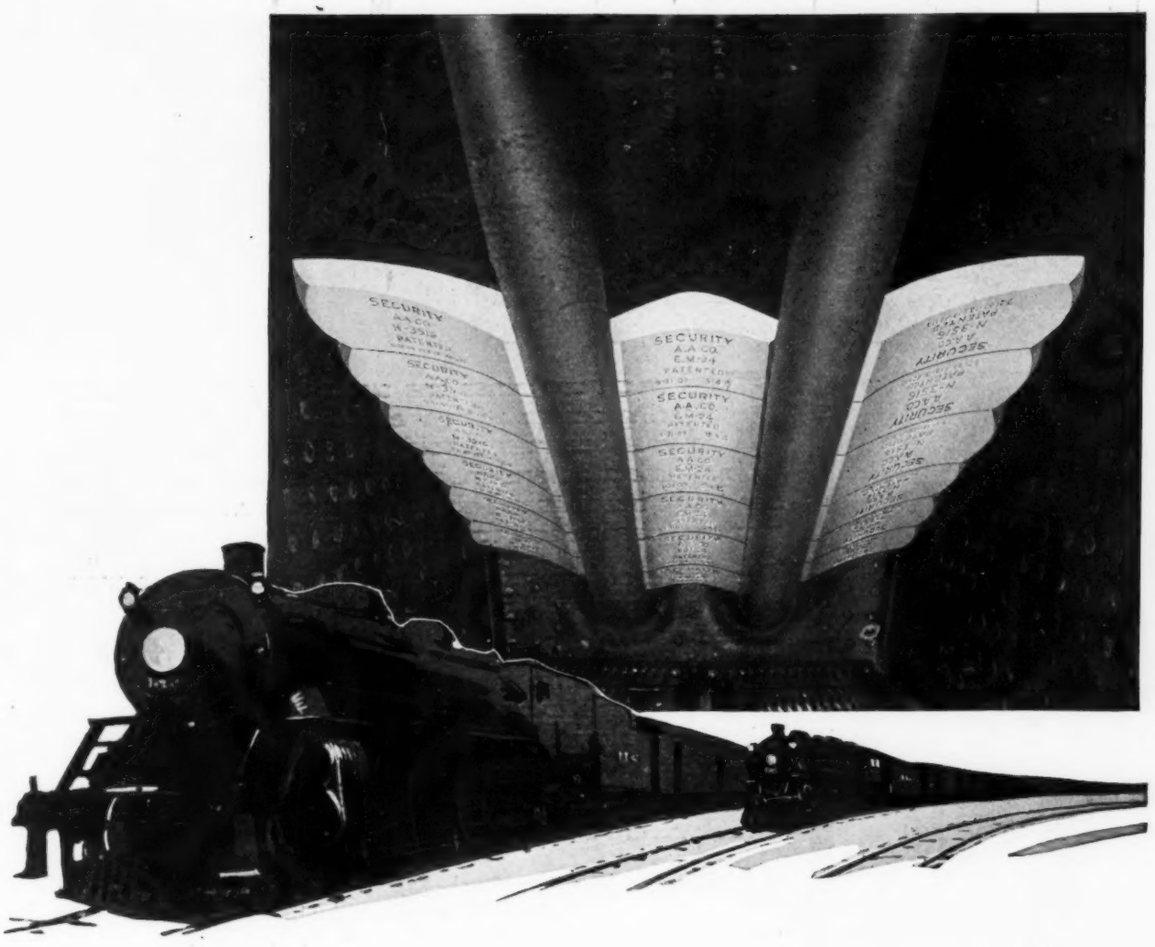
This results in lower bearing pressures and reduced maintenance on all bearings.



When two driving axles are coupled up by means of the Tandem Main Rod Drive it is obvious that slipping tendencies are materially reduced, again lowering maintenance.

FRANKLIN RAILWAY SUPPLY COMPANY, Inc.

NEW YORK CHICAGO SAN FRANCISCO
ST. LOUIS MONTREAL



Locomotives Are Working Arch Brick Intensely

Long runs, heavier trains and higher speeds work the locomotive more severely than ever before.

Mileage builds up in a surprisingly short time.

Where the locomotive once loafed, it is now forced to do a stiff day's work.

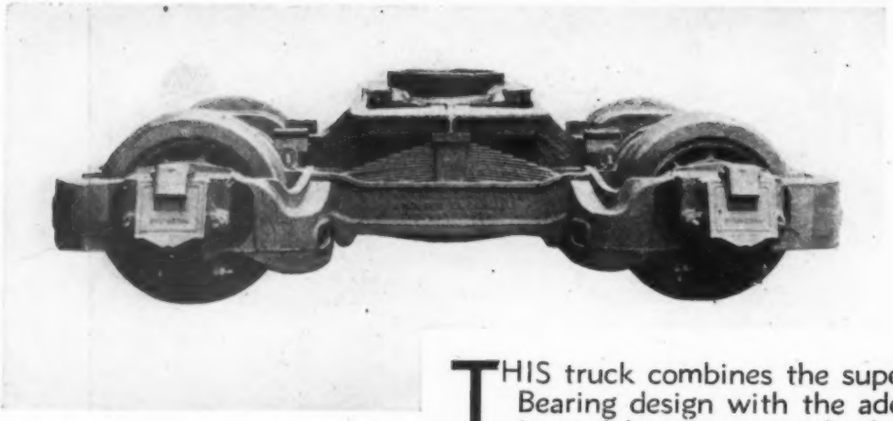
Work for the locomotive means work for the locomotive Arch.

Today the Arch makes its mileage in much shorter time than it did a few years ago and under far more severe conditions.

Everything considered, Arch Brick render better service today than they ever did—a tribute to the constant efforts of the American Arch Company in developing the locomotive Arch.

Harbison-Walker Refractories Co.
Refractory Specialists

American Arch Co.
INCORPORATED
Locomotive Combustion
. . . Specialists . . .



THIS truck combines the superiority of our Inside Bearing design with the additional advantage of journal bearings outside the wheels, thus facilitating inspection and maintenance as with car or tender truck bearings. This is a real advantage on locomotives, particularly for long runs.

The frame comprises castings laid together in a manner providing maximum flexibility and requires but three patterns.

Long flexible springs with large deflection range accommodate the excess loads due to sudden brake application, lateral resistance movement and rolling of the locomotive.

The wide journal spread minimizes bearing overload when passing curves.

A.R.A. Standard Journal Bearings, Wedges, and Box Lids are used, also A.R.A. Standard Axles, by removing a small amount of metal. Wheels with large diameter outside hub wearing faces absorb the wear caused by lateral guiding pressures, end axle collars being omitted to allow free lateral movement of the brasses on the journals for I.C.C. hub play limitations.

Hub liners may be riveted on, floating, or of the ALCO removable type.

A.R.A. Bearings and Wedges give perfectly equalized pressure over the entire journal surfaces and are of great value in eliminating hot boxes.

Equalizers seat on hardened steel rollers placed at right angles to each other, allowing the free rise and fall of individual wheels without disturbing the weight equalization.

ALCO

OUTSIDE BEARING ENGINE TRUCK

AMERICAN LOCOMOTIVE COMPANY

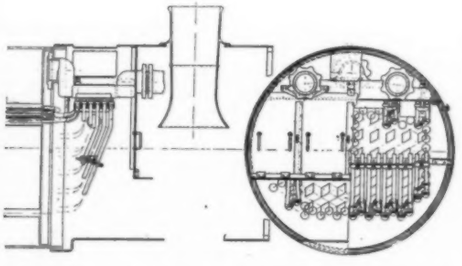
30 Church St., New York, N. Y.

A Question of Capacity

To supply the power needed for modern train operation, sustained boiler capacity is an item of design most carefully considered.

Elesco superheaters are essential to provide this boiler capacity which enables locomotives to successfully meet present-day operating conditions.

The sustained boiler capacity that Elesco superheaters add to any boiler is playing a very important part in our efficient operation of steam locomotives today.



Elesco Type "E" Locomotive Superheater Assembly

THE SUPERHEATER COMPANY

60 East 42nd Street
NEW YORK

ELESCO

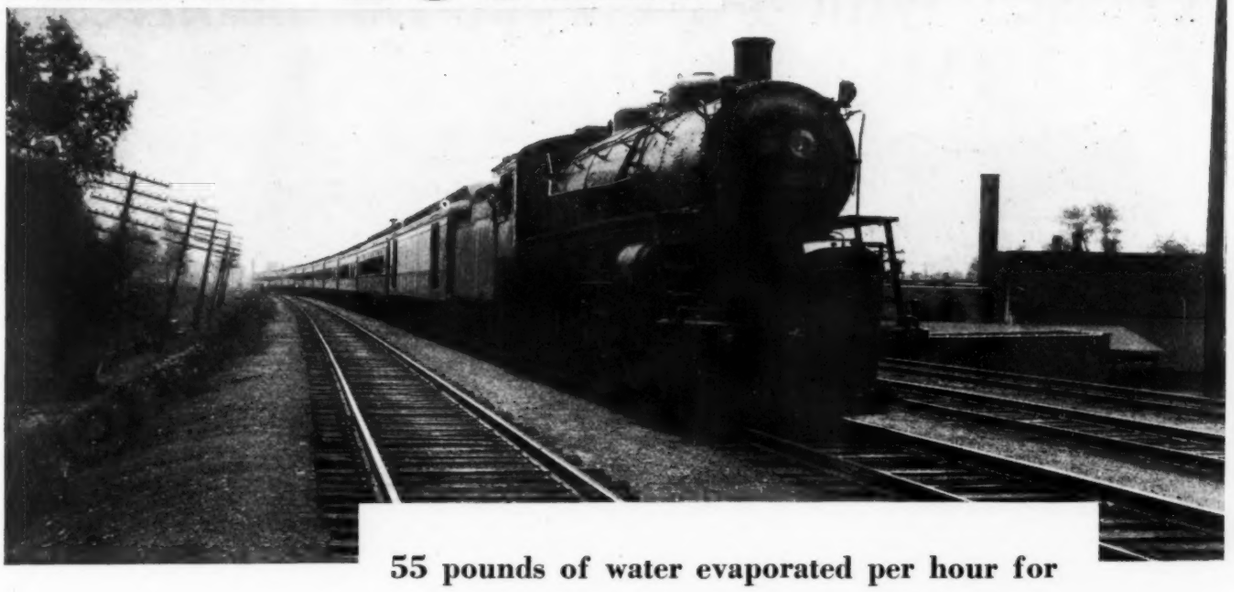
Peoples Gas Building
CHICAGO

Canada: The Superheater Company, Limited, Montreal

Feed Water Heaters · Superheaters · Superheated Steam Pyrometers · Exhaust Steam Injectors

A-478

HEAT LOSSES



55 pounds of water evaporated per hour for each square foot of heating surface for the firebox is an established fact. Present day grates require heavy fires. As much as 40 sq. ft. of firebox heating surface in the modern locomotive is blanked off by the fuel bed—just a way of losing 100 Boiler H.P.

FIREBARS that make

BETTER FIRES

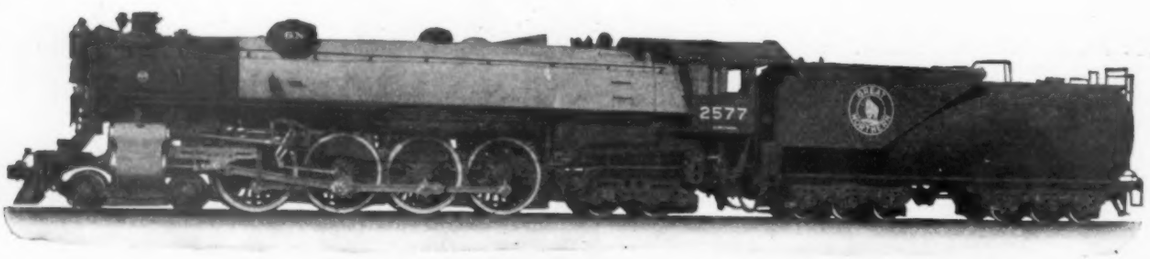
require an extremely thin one and return for evaporative service these valuable side and back firebox sheets.

FIREBAR CORPORATION

CLEVELAND OHIO

FIREBAR

Great Northern Railway Pleased With 4-8-4 Type Locomotives



DIMENSIONS AND WEIGHTS	
Cylinders	29″ x 29″
Drivers, diameter	80″
Steam pressure	225 lb.
Grate area	97.7 sq. ft.
Water heating surface	4781 sq. ft.
Superheating surface	2265 sq. ft.
Weight on drivers	247,300 lb.
Weight, total engine	420,900 lb.
Tractive force	58,300 lb.

THE GREAT NORTHERN RAILWAY has in service fourteen locomotives of Class S-2, which were built by The Baldwin Locomotive Works early in the present year. These locomotives are of the 4-8-4 type, with driving wheels 80 inches in diameter, and they are used in fast passenger service on comparatively level divisions.

The following quotation from a letter written under date of April 26, 1930, by Mr. William Kelly, General Superintendent of Motive Power of the Great Northern, to Mr. S. M. Vauclain, Chairman of the Board of The Baldwin Locomotive Works, and published by permission of the writer, plainly shows how these locomotives are regarded:—

"We are all very much pleased with them. They are certainly wonderful locomotives, and if we were getting more of them, as far as we know now, we would make no changes of any kind.

"I feel that The Baldwin Locomotive Works is entitled to a great deal of credit for turning out what is considered, by all who have inspected them, to be the finest passenger engines they have ever seen.

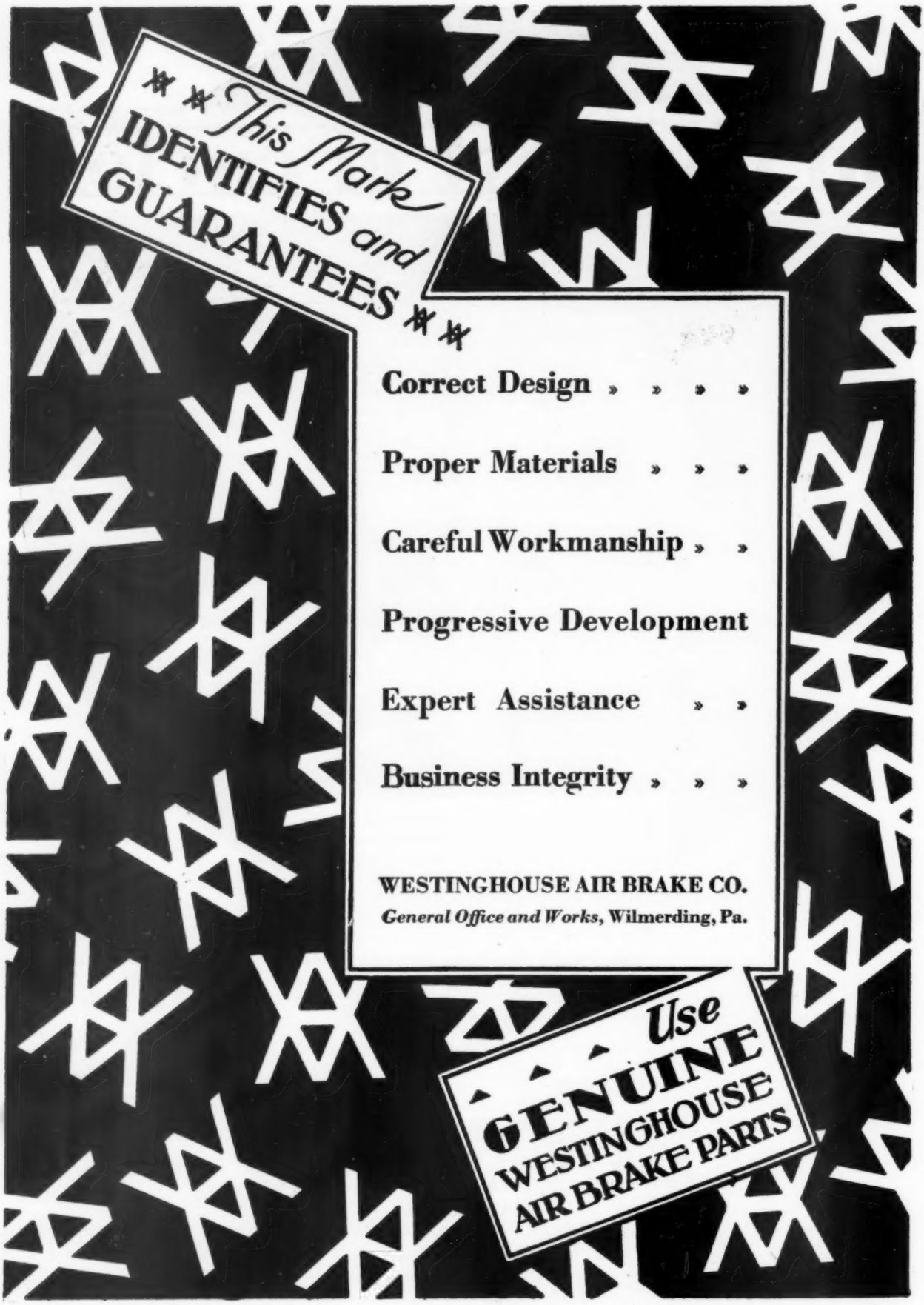
"We are now handling our through limited trains—the Empire Builder, the Oriental Limited, and the Fast Mail—from St. Paul to Seattle, about 1800 miles, entirely with Baldwin power, except in the electrified zone; and I believe that no other railroad in the country has better power, and that comparatively few have as good."

1831 BLW 1930

It is naturally gratifying to us to receive an opinion like this, and we congratulate the Railway Company upon the fine results that they are securing with these locomotives.

THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA


This Mark
IDENTIFIES and
GUARANTEES
Correct Design
Proper Materials
Careful Workmanship
Progressive Development
Expert Assistance
Business Integrity
WESTINGHOUSE AIR BRAKE CO.
General Office and Works, Wilmerding, Pa.
Use
GENUINE
WESTINGHOUSE
AIR BRAKE PARTS

PROFESSIONAL DIRECTORY

Second Hand Equipment — Get Together Department — Factory and Railroad Equipment

POSITION OPEN

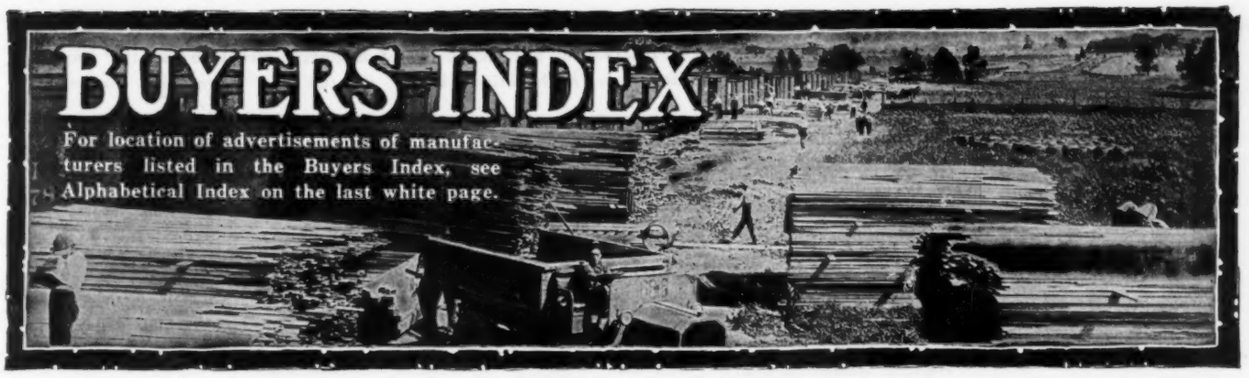
IF you are open to overtures for new connection, and qualified for a salary between $2,500 and $25,000, your response to this announcement is invited. The undersigned provides a thoroughly organized service of recognized standing and reputation, through which preliminaries are negotiated confidentially for positions of the calibre indicated. The procedure is individualized to each client's personal requirements; your identity covered and present position protected. Established twenty years. Send only name and address for details. R. W. Bixby, Inc., 102 Downtown Building, Buffalo, New York.

POSITION WANTED

WANTED—Position by experienced valuation accountant familiar with all requirements under order No. 3. Address Box 795, RAILWAY AGE, 30 Church St., New York City.

EDUCATIONAL

SEND for Free Special Bulletin and learn how to increase your knowledge of practical railroad work and fit yourself for promotion. The Railway Educational Bureau, Omaha, Neb.



Airplanes.
Bender Body Co.
Aftercoolers, Air.
Ingersoll-Rand Co.
Air Brakes.
Westinghouse Air Brake Co.
Aircraft Corrugated Sheet.
Aluminum Co. of America.
Aircraft Extruded & Rolled Shapes.
Aluminum Co. of America.
Aircraft Plates.
Aluminum Co. of America.
Aircraft Screw Machine Products.
Aluminum Co. of America.
Aircraft Streamline & Round Tubing.
Aluminum Co. of America.
Air Lifts.
Ingersoll-Rand Co.
Airport Drainage.
Armco Culvert Mfrs. Assoc.
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Union Asbestos & Rubber Co.
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Bethlehem Steel Co.
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American Arch Co.
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Axles, Car and Locomotive.
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Illinois Steel Co.
Lima Locomotive Works.
Midvale Co., The.
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Standard Steel Works Co.
Axles Mine Car.
Brill Co., The J. G.
Mt. Vernon Car Mfg. Co.
Axles, Motor Trucks.
Timken-Detroit Axle Co.
Babbit Metal.
National Bearing Metals Corp.
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American Bridge Co.
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Inland Steel Company.
Interstate Iron & Steel Co.
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Scullin Steel Co.
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Ewald Iron Co.
Falls Hollow Staybolt Co.
Illinois Steel Co.
Inland Steel Co.
Interstate Iron & Steel Co.
Lockhart Iron & Steel Co.
McConway & Torley Co.
National Railway Appliance Co.
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Carnegie Steel Co.
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Electric Storage Battery Co.
Batteries, Starting.
Electric Storage Battery Co.
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Electric Storage Battery Co.
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Batteries, Wet Cell.
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Bearings, Ball Thrust.
S. K. F. Industries, Inc
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Miner, W. H.
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Bearings, Roller Side.
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C & C Company, The
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W & B Co., The.
Bearings, Side.
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Standard Car Truck Co.
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Wine Railway Appliance Co.
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Bells, Highway Crossing.
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Birdsboro Steel Foundry & Mach. Co.
Benders, Rail.
Q & C Co., The.
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Carnegie Steel Co.
Central Alloy Steel Corp.
Illinois Steel Co.
Inland Steel Co.
Interstate Iron & Steel Co.
McConway & Torley Co.
Midvale Co., The.
Ryerson & Son, Joseph T.
Scullin Steel Co.
Blocks, Chain.
Barco Mfg. Co.
Yale & Towne Manufacturing Co
Blocks, Creosoted.
American Creosoting Co.
Central Coal & Coke Co.
Century Wood Preserving Co.
International Creosoting & Constr. Co.
Jennison-Wright Co.
Michigan Wood Preserving Co.
New England Wood Preserving Co.
Ohio Wood Preserving Co.
Pittsburgh Wood Preserving Co.
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Alan Wood Steel Co.
Carnegie Steel Co.
Central Alloy Steel Corp.
Interstate Iron & Steel Co.
Blow Pipe Systems, Pneumatic.
Mahon Co., R. C.
Blower Fittings, Automatic Smokebox.
Barco Mfg. Co.
Blowers, Soot.
Rees Mfg. Co.
Blowers, Turbo.
Ingersoll-Rand Co.
Blow Off Line Joints, Roundhouse—(See Joints, etc.).
Bodies, Coach.
Bender Body Co.
Boiler Checks.
Prime Manufacturing Co., The.
Boilers, Heaters.
American Radiator Co.
Boilers, Locomotive.
American Locomotive Co.
Baldwin Locomotive Works
Lima Locomotive Works.
Boilers, Scale Proof.
Industrial Brownhoist Corp.
Boilers, Water Tube.
Babcock & Wilcox Tube Co.
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Bettendorf Co., The.
Birdsboro Steel Foundry & Mach. Co.
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Brill Co., The J. G.
Buckeye Steel Castings Co.
Gould Coupler Co., The.
Mt. Vernon Car Mfg. Co.
Ohio Steel Foundry Co., The.
Pressed Steel Car Co.
Scullin Steel Co.
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Buffalo Bolt Co.
Buffalo Brake Beam Co.
Neely Nut & Bolt Co.
Russell, Burdsall & Ward Bolt and Nut Co,.
Ryerson & Son, Joseph T.
Westinghouse Elec. & Mfg. Co.
Wrought Iron Co. of America.
Bolts & Nuts, Monel Metal.
International Nickel Co., The.
Bolts, Patch.
Falls Hollow Staybolt Co.
Ryerson & Son, Joseph T.
Bolts, Track.
Buffalo Bolt Co.
Illinois Steel Co.
Inland Iron & Steel Co.
Wrought Iron Co. of America.
Bonders, Rail.
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Bonding Rail Outfits.
Ingersoll-Rand Co.
Bonds, Rail.
American Steel & Wire Co.
Railroad Supply Co.
Westinghouse Elec. & Mfg. Co.
Bonds, Signal.
American Steel & Wire Co.
Railroad Supply Co.
Bond Wire Protection.
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Sellers & Co., Inc., Wm.
Boring & Turning Mills, Horizontal.
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Boring & Turning Mills, Vertical.
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National Malleable & Steel Castings Co.
Q & C Co., The.
Ramapo Ajax Co.
Symington Co., The.
Brake Beam Safety Guards.
Chicago Railway Equipment Co.
Brake Beam Supports.
American Steel Foundries.
Brill Co., The J. G.
Chicago Railway Equipment Co.
Davis Brake Beam Co.
Brake Beams.
American Steel Foundries.
Bradford Corporation.
Buffalo Brake Beam Co.
Chicago Railway Equipment Co.
Davis Brake Beam Co.
Hunt-Spiller Mfg. Corp.
Mt. Vernon Car Mfg. Co.
National Malleable & Steel Castings Co.
National Railway Appliance Co.
Pressed Steel Car Co.
Brake Drums.
Hunt-Spiller Mfg. Corp.
Brake Forgings, Pins, Levers, etc.
American Steel Foundries.
Brill Co., The J. G.
Davis Brake Beam Co.
Mt. Vernon Car Mfg. Co.
National Railway Appliance Co.
Schaefer Equipment Co.
Brakes, Hand.
National Brake Co.
Klasing Car Brake Co.
Brake Heads.
American Brake Shoe & Foundry Co.
American Steel Foundries.
Brill Co., The J. G.
Chicago Railway Equipment Co.
Davis Brake Beam Co.
Pressed Steel Car Co.
Brake Jaws.
Mt. Vernon Car Mfg. Co.
National Malleable & Steel Castings Co.
National Railway Appliance Co.
Schaefer Equipment Co.
Steel Car Forge Co.
Brake Shoes.
American Brake Shoe & Foundry Co.
American Steel Foundries.
Brill Co., The J. G.
Buckeye Steel Castings Co.
Fort Pitt Malleable Iron Co.
Mt. Vernon Car Mfg. Co.
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General Electric Co.
Westinghouse Air Brake Co.
Brakes, Clasp.
American Steel Foundries.
Brakes, Electric.
Westinghouse Air Brake Co.
Brakes, Hand.
Miner, W. H.
National Brake Co.
National Malleable & Steel Castings Co.
Wine Railway Appliance Co.
Brick, Locomotive Arch.
American Arch Co.
Bridge Builders.
American Bridge Co.
Bethlehem Steel Company.
Bridge Floors.
Armco Culvert Mfrs. Assoc.
Bridge & Crossing Plank, Creosoted.
International Creosoting & Construction Co.
National Lumber & Creosoting Co.
Bridge Material.
International Creosoting & Construction Co.
Bridge Material, Creosoted.
National Lumber & Creosoting Co.
Bridge Stringers — (See Stringers, Bridge).
Bronze Powder, Aluminum.
Aluminum Co. of America.
Milwaukee Electric Crane & Hoist Corp.
Bucket Handling.
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Whiting Corporation.
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Bethlehem Steel Co.
Bettendorf Co., The.
Birdsboro Steel Foundry & Mach. Co.
Buckeye Steel Castings Co.
Burnside Steel Foundry Co.
Gould Coupler Co., The.
McConway & Torley Co.
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Ohio Steel Foundry Co., The.
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Birdsboro Steel Foundry & Mach. Co.
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Cleaners, Air Pump.
Oakite Products, Inc.
Westinghouse Air Brake Co.

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Oakite Products, Inc.

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Orton Crane & Shovel Co.
Roberts & Schaefer Co.

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Standard Stoker Co.

Coaling Stations.
American Bridge Co.
Fairbanks-Morse & Co.
Railway Engineering Equipment Co.
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Prime Manufacturing Co., The.

Cocks, Gauge.
Bird-Archer Co., The.

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Whiting Corporation.

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Oakite Products, Inc.

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Oakite Products, Inc.

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Oakite Products, Inc.

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Oakite Products, Inc.

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Gould Coupler Co., The.
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Standard Coupler Co.
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Ingersoll-Rand Co.

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Ingersoll-Rand Co.

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Ingersoll-Rand Co.

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General Electric Co.
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General Electric Supply Corp.

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General Electric Supply Corp.

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Battey & Kipp.
United Engineers & Constructors, Inc.

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Battey & Kipp.
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Muhlfeld, John E.
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Gulick-Henderson Co.
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United Engineers & Constructors, Inc.

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Hunt Co., Robert W.
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Ingersoll-Rand Co.
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Industrial Brownhoist Corp
Orton Crane & Shovel Co.

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American Hoist & Derrick Co.
Industrial Brownhoist Corp.

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Carey Co., Philip, The.

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Union Asbestos & Rubber Co.

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General Electric Supply Corp.

Expanders, Tube.
Ryerson & Son, Joseph T.

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American Steel & Wire Co.

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Westinghouse Elec. & Mfg. Co.

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Fort Pitt Malleable Iron Co.
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National Malleable & Steel Castings Co.

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Ferro Chromium.
Vanadium Corp. of America

Ferro Molybdenum
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Vanadium Corp. of America

Ferro Tungsten.
Vanadium Corp. of America

Ferro Vanadium.
Vanadium Corp. of America

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Whiting Corporation.
Filters, Dust.
Whiting Corporation.
Fireboxes.
American Locomotive Co.
Baldwin Locomotive Works
Locomotive Firebox Co.
Fire Fighting & Protection Equipment.
Johns-Manville Corp.
Fittings, Air Brakes.
Westinghouse Air Brake Co.
Fittings, Steam.
Vapor Car Heating Co. Inc.
Fixtures, Car Door.
Camel Sales Co.
Chicago Railway Equipment Co.
Miner, W. H.
National Malleable & Steel Castings Co.
Flangers, Snow.
Q & C Co., The.
Floodlights.
General Electric Supply Corp.
Graybar Electric Co.
Oxweld Railroad Service Co.
Pyle-National Co.
Symington Co., The.
Westinghouse Elec. & Mfg. Co.
Flooring.
Carey Co., Philip, The.
Carey & Co., Philip.
Industrial Lumber Co.
Jennison-Wright Co.
Johns-Manville Corp.
Flooring, Car.
Tuco Products Corp.
Flooring, Coach.
Tuco Products Corp.
Flooring, Composition.
Johns-Manville Corp.
Tuco Products Corp.
Flooring, Creosoted.
Central Coal & Coke Co.
Flooring, Wood.
Central Coal & Coke Co.
Century Wood Preserving Co.
Industrial Lumber Co.
Floor Plates, Steel.
Alan Wood Steel Co.
Carnegie Steel Co.
Floor Slabs, Concrete.
American Cement Tile Mfg. Co.
Flue Cleaners—(See Cleaners, Flue).
Flue Cutters—(See Cutters, Flue)
Flues, Boiler — (See Tubes Boiler).
Flue Shop Equipment.
Ryerson & Son, Joseph T.
Forges, Rivet Heating.
Ryerson & Son, Joseph T.
Forging Hammers.
Industrial Brownhoist Corp
Forgings.
American Bridge Co.
American Steel Foundries.
Bethlehem Steel Company.
Brill Co., The J. G.
Carnegie Steel Co.
Edgewater Steel Co.
General Railway Signal Co.
Gould Coupler Co., The.
Illinois Steel Co.
Midvale Co., The.
Mt. Vernon Car Mfg. Co.
National Railway Appliance Co.
Neely Nut & Bolt Co.
Pressed Steel Car Co.
Standard Steel Works Co.
Steel Car Forge Co.
Universal Draft Gear Attachment Co.
Forgings, Drop.
Brill Co., The J. G.
General Railway Signal Co.
Oliver Iron & Steel Corp.
Steel Car Forge Co.
Union Switch & Signal Co.
Forgings, Monel Metal.
International Nickel Co. The.
Foundry Equipment.
Whiting Corporation.
Foundry Supplies.
Bird-Archer Co., The.
Frames, Locomotive.
American Steel Foundries.
American Locomotive Co.
Baldwin Locomotive Wks.
Birdsboro Steel Foundry & Mach. Co.
Ohio Steel Foundry Co., The.
Scullin Steel Co.
Union Steel Casting Co.
Frames, Truck.
American Locomotive Co.
American Steel Foundries.
Baldwin Locomotive Works
Bettendorf Co., The.
Birdsboro Steel Foundry & Mach. Co.
Buckeye Steel Castings Co.
Brill Co., The J. G.
Franklin Railway Supply Co., Inc.
General Steel Castings Corp. — (Commonwealth Division).
Gould Coupler Co., The.
Ohio Steel Foundry Co., The.
Pressed Steel Car Co.
Pyle-National Co.
Scullin Steel Co.
Symington Co., The.
Frames, Vanadium.
American Locomotive Co.
Baldwin Locomotive Wks.
Birdsboro Steel Foundry & Mach. Co.
Union Steel Casting Co.
Frogs and Crossings.
Bethlehem Steel Company.
Ramapo Ajax Corp.
Fulcrums, Brake Beam.
American Steel Foundries.
Brill Co., The J. G.
Chicago Railway Equipment Co.
National Malleable & Steel Castings Co.
Furnaces, Electric.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Furnaces, Gasoline.
Railroad Supply Co.
Whiting Corporation.
Furnaces, Rivet Heating—(See Forges, Rivet Heating).
Furniture.
Aluminum Co. of America.
Gage Testers—(See Testers Gage).
Gages, Air.
Westinghouse Air Brake Co.
Gages, Steam.
Ashton Valve Co.
Gages, Tire.
Schrader's Son, Inc., A.
Gages, Water Press Recording.
Ashton Valve Co.
Gaskets.
Westinghouse Air Brake Co.
Gasoline.
Ethyl Gasoline Corp.
Gear Blanks, Rolled Steel.
Standard Steel Works Co.
Gears and Pinions.
American Steel Foundries.
National Railway Appliance Co.
Westinghouse Elec. & Mfg. Co.
Gears, Silent.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Gears, Valve — (See Valve Gears).
Generators, Acetylene.
Oxweld Railroad Service Co.
Generators, Car Lighting.
Safety Car Heating & Lighting Co.
Generators, Electric.
Fairbanks-Morse & Co.
General Electric Co.
Graybar Electric Co.
National Railway Appliance Co.
Sunbeam Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Generators, Gasoline Engine Driven.
Kohler Company.
Sunbeam Electric Mfg. Co.
Grade Crossing Paving, Metal
Alan Wood Steel Co.
Graders, Elevating.
Western Wheeled Scraper Co.
Graphite Penetrating Oil.
Alemite Mfg. Corp.
Grapples, Wood.
Industrial Brownhoist Corp.
Grate Bars.
Q & C Co., The.
Grate Shakers, Automatic.
Franklin Railway Supply Co., Inc.
Grates.
Firebar Corp.
Greases.
Alemite Mfg. Corp.
Grease Forming Machines.
Franklin Railway Supply Co., Inc.
Grey Iron.
American Brake Shoe & Foundry Co.
Grinders, Cylinder.
Hutto Engineering Co.
Grinding Machines.
Sellers & Co., Inc., Wm.
Grinding Machines, Portable.
Ingersoll-Rand Co.
Guard Rails, Creosoted Wood
International Creosoting & Construction Co.
Guard Rails, Foot Guard.
Q & C Co., The.
Guard Rails (One Piece).
Bethlehem Steel Company.
Ramapo Ajax Corp.
Guard Switch Point.
Q & C Co., The.
Guards, Cattle.
American Bridge Co.
Guards, Dust.
Gould Coupler Co., The.
Symington Co., The.
Hair Felt.
Johns-Manville Corp.
Hammers, Pneumatic.
Ingersoll-Rand Co.
Hammers, Riveting.
Ingersoll-Rand Co.
Hammers, Steam.
Industrial Brownhoist Corp.
Sellers & Co., Inc., Wm.
Hand Brakes—(See Brakes, Hand).
Hangers, Ball Bearing.
S. K. F. Industries, Inc.
Hand Rails & Fittings.
Aluminum Co. of America.
Hangers, Bottom Rod Safety
Chicago Railway Equipment Co.
Hangers, Car Door—(See Fixtures, Car Door).
Headlight Repair Parts, Electric.
Electric Service Supplies Co.
Pyle-National Co.
Sunbeam Electric Mfg. Co.
Headlights, Electric.
General Electric Co.
Sunbeam Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.
Headlights, Reflectors & Cases
Pyle-National Co.
Sunbeam Electric Mfg. Co.
Headlining.
Pantasote Co., Inc., The.
Heaters, Electric.
Gold Car Heating & Lighting Co.
Westinghouse Electric & Mfg. Co.
Heaters, Electric Rivet.
American Hoist & Derrick Co.
Heaters, Feedwater.
Worthington Pump & Machinery Corp.
Heaters, Feedwater Locomotive.
Superheater Company, The.
Heaters, Feed Water, Stationary.
Brill Co., The J. G.
Gold Car Heating & Lighting Co.
Worthington Pump & Machinery Corp.
Heating Systems.
Air-Way Electric Appliance Corp.
Heating & Ventilating Apparatus.
National Railway Appliance Co.
Vapor Car Heating Co., Inc.
Westinghouse Electric & Mfg. Co.
Heating Equipment, Car.
Gold Car Heating & Lighting Co.
Safety Car Htg. & Ltg. Co.
Vapor Car Heating Co., Inc.
Wine Railway Appliance Co.
Heating Systems, Car (Electric and Steam).
Gold Car Heating & Lighting Co.
Safety Car Htg. & Ltg. Co.
Vapor Car Heating Co., Inc.
Wine Railway Appliance Co.
High Temperature Cements.
Carey Co., Philip, The.
Highway Crossing Protection Devices.
American Bridge Co.
Franklin Railway Supply Co., Inc.
Railroad Supply Co.
Hoists, Air.
Whiting Corporation.
Hoists, Locomotive.
Whiting Corporation.
Hoists, Car, Coach.
Whiting Corporation.
Hoists, Chain.
Milwaukee Electric Crane & Hoist Corp.
Ryerson & Son, Jos. T.
Hoists, Electric.
American Hoist & Derrick Co.
Milwaukee Electric Crane & Hoist Corp.
Yale & Towne Mfg. Co.
Hoists, Pneumatic.
Ingersoll-Rand Co.
Hoists, Portable Car
Whiting Corporation.
Hoists, Second-Hand.
Hyman-Michaels Co.
Hoisting Machinery.
American Hoist & Derrick Co.
Industrial Brownhoist Corp.
Orton Crane & Shovel Co.
Milwaukee Electric Crane & Hoist Corp.
Hooks, Wrecking.
National Malleable & Steel Castings Co.
Horns, Pneuphonic.
Westinghouse Air Brake Co.
Hose, Air, Steam, Etc.
Ingersoll-Rand Co.
Westinghouse Air Brake Co.
Hose, Tender.
Prime Manufacturing Co., The.
Westinghouse Air Brake Co.
Ice Cutters.
Jordan Co., O. F.
Incandescent Lamps.
General Electric Supply Corp.
Indicators, Speed & Cut-off
Valve Pilot Co.
Ingots.
Birdsboro Steel Foundry & Mach. Co.
Carnegie Steel Co.
Edgewater Steel Co.
Illinois Steel Co.
Interstate Iron & Steel Co.
McConway & Torley Co
Injectors, Exhaust Steam.
Sellers & Co., Inc., Wm.
Superheater Co., The.
Inspection of Material and Equipment — (See Engineers, Insnection).
Insulated Wire.
General Electric Supply Corp.
Insulating Lumber.
Celotex Company, The.
Insulation, Car, Bldg.
Celotex Company, The.
Johns-Manville Corp.
National Railway Appliance Co.
Tuco Products Corp.
Union Asbestos & Rubber Co.
Insulation, Car Roofing, Exhaust.
Carey Co., Philip, The.
Insulation, Electrical.
Carey Co., Philip, The.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Insulation, Exhaust & Heat-
Carey Co., Philip, The.
er Pipe.
Johns-Manville Corp.
Tuco Products Corp.
Union Asbestos & Rubber Co.
Insulation, Heat.
Carey Co., Philip, The.
Celotex Company, The.
Miner, W. H.
Insulation Tape.
General Electric Supply Corp.
Insulators, Electrical, Porcelain.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.
Interlocking Plant Equipment.
General Railway Signal Co.
Union Switch & Signal Co.
Iron Chain.
Falls Hollow Staybolt Co.
Lockhart Iron & Steel Co.
Wrought Iron Co. of America.
Iron, Charcoal.
Ewald Iron Co.
Falls Hollow Staybolt Co.
Lockhart Iron & Steel Co.
Wrought Iron Research Association.
Bethlehem Steel Co.
Iron Engine Bolt.
Lockhart Iron & Steel Co.
Wrought Iron Co. of America.
Wrought Iron Research Association.
Iron, Forging Billets.
Lockhart Iron & Steel Co.
Iron, Hollow Staybolt.
Falls Hollow Staybolt Co.
Ryerson & Son, Joseph T.
Iron, Hollow Staybolt Bars.
Bethlehem Steel Company.
Falls Hollow Staybolt Co.
Illinois Steel Co.
Ryerson & Son, Joseph T.
Iron, Pig.
Bethlehem Steel Co.
Iron, Refined.
Ewald Iron Co.
Falls Hollow Staybolt Co.
Lockhart Iron & Steel Co.
National Railway Appliance Co.
Reading Iron Co.
Ryerson & Son, Joseph T.
Wrought Iron Co. of America.
Iron, Staybolt — (See also Staybolts).
Ewald Iron Co.
Falls Hollow Staybolt Co.
Interstate Iron & Steel Co.
Lockhart Iron & Steel Co.
Reading Iron Co.
Ryerson & Son, Joseph T.
Wrought Iron Co. of America.
Wrought Iron Research Association.
Jacks, Smoke.
Johns-Manville Corp.
Jacks, Screw Electric—Locomotive & Car Lifting.
Whiting Corporation.
Joints, Air Reservoir.
Barco Mfg. Co.
Franklin Railway Supply Co., Inc.
Joints, Blow Off Line (Roundhouse).
Barco Mfg. Co.
Franklin Railway Supply Co., Inc.
Joints, Coach and Coach Yard.
Barco Mfg. Co.
Franklin Railway Supply Co., Inc.
Joints, Flexible.
Franklin Railway Supply Co., Inc.
Vapor Car Heating Co., Inc.
Joints, Flexible Ball.
Barco Mfg. Co.
Joints, Rail.
American Steel Foundries.
Carnegie Steel Co.
Illinois Steel Co.
Q & C Co., The.
Rail Joint Co.
Union Switch & Signal Co.
Joints, Steam, Air and Liquid.
Barco Mfg. Co.
Franklin Railway Supply Co., Inc.
Vapor Car Heating Co., Inc.
Joints, Swing.
Barco Mfg. Co.
Vapor Car Heating Co., Inc.
Journal Boxes and Lids.
Allegheny Steel Co.
American Steel Foundries.
Brill Co., The J. G.
Gould Coupler Co., The.
Hunt-Spiller Mfg. Corp.
National Malleable & Steel Castings Co.
Pullman Car & Mfg. Corp.
Railway Steel Spring Co.
Symington Co., The.
Union Spring & Mfg. Co.
Journal Oilers, Car & Locomotive.
Ardco Mfg. Co.

Keys, Brake Shoe.
Bradford Corporation.
Mt. Vernon Car Mfg. Co
Steel Car Forge Co.
Union Spring & Mfg. Co.

Knuckles, Emergency.
Q & C Co., The.

Laboratories, Testing.
Hunt Co., Robert W.
Pittsburgh Testing Laboratory.

Lacquers.
Berry Bros.
General Electric Supply Corp.
Sherwin-Williams Co.

Ladders, Steel Car.
Wine Railway Appliance Co.

Lagging, Locomotive.
Carey Co., Philip, The.
Johns-Manville Corp.

Lamps, Incandescent.
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Inspector's.
Union Carbide Sales Co.

Lath, Metal.
American Rolling Mill Co., The.

Lathes, Automatic Chucking and Turning.
Bullard Co., The.

Lathes, Axle.
Sellers & Co., Inc., Wm.

Lathes, Drum Truing.
National Railway Appliance Co.

Lathes, Turret Vertical.
Bullard Co., The.

Lathes, Engine.
Ryerson & Son, Joseph T.

Lathes, Wheel.
Sellers & Co., Inc., Wm.

Lead, White.
National Lead Co.

Lighting Equipment, Car.
Electric Storage Battery Co.
Safety Car Htg. & Ltg. Co.

Lighting Equipment, Car & Coach.
National Railway Appliance Co.

Lighting Fixtures and Systems.
General Electric Supply Corp.
Graybar Electric Co.
Pyle-National Co.
Safety Car Htg. & Ltg. Co.

Lighting Plants, Gas, Electric.
Kohler Company.
Sunbeam Electric Mfg. Co.

Lightning Arrestors.
General Electric Supply Corp.

Line Material.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.

Lock Nuts—(See Nut Locks).

Locks and Padlocks.
Yale & Towne Mfg. Co.

Locomotives, Contractors.
American Locomotive Co.
Baldwin Locomotive Works.
Lima Locomotive Works.

Locomotives, Electric.
American Locomotive Co.
Baldwin Locomotive Works
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Locomotives, Gasoline.
Baldwin Locomotive Works.

Locomotives, Gas-Electric.
Electro Motive Co.

Locomotives, Geared.
Lima Locomotive Works.

Locomotives, Industrial.
American Locomotive Co.
Baldwin Locomotive Works.
General Electric Co.
Lima Locomotive Works.
Westinghouse Elec. & Mfg. Co.

Locomotives, Mine.
American Locomotive Co.
Baldwin Locomotive Works.
General Electric Co.
Lima Locomotive Works.
Westinghouse Elec. & Mfg. Co.

Locomotives, Oil, Engine, Electric Driven.
American Locomotive Co.
Baldwin Locomotive Works
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Locomotives, Rebuilt.
American Locomotive Co.

Locomotives, Repair Parts.
American Locomotive Co.
Baldwin Locomotive Works.
Lima Locomotive Works.
National Railway Appliance Co.

Locomotives, Second-Hand.
Lyman-Michaels Co.

Locomotives, Steam.
American Locomotive Co.
Baldwin Locomotive Works.
Lima Locomotive Works.

Locomotive Stokers.
Standard Stoker Co.

Locomotive Valve Pilot
Valve Pilot Co.

Lubricants.
Alemite Mfg. Corp.

Lubrication Equipment.
Alemite Mfg. Corp.

Lubrication Systems.
Alemite Mfg. Corp.

Lubricators, Driving Box.
Franklin Railway Supply Co., Inc.

Lubricators, Piston Rod.
Q & C Co., The.

Lumber.
Central Coal & Coke Co.
Curtin-Howe Corp.
Eppinger & Russell Co.
West Coast Lumber Trade Extension Bureau.
Industrial Lumber Co.

Lumber, Asbestos.
Carey Co., Philip, The.
Johns-Manville Corp.

Lumber, Creosote Treated.
International Creosoting & Construction Co.

Lumber, Creosoted.
American Creosoting Co.
Central Coal & Coke Co.
Century Wood Preserving Co.
Industrial Lumber & Creosoting Co.
International Creosoting & Construction Co.
Jennison-Wright Co.
National Lumber & Creosoting Co.

Lumber, Insulating.
Celotex Co., The.

Machinery, Hydraulic.
Birdsboro Steel Foundry & Mach. Co.

Machine Screws, Monel Metal.
International Nickel Co., The.

Magnets, Lifting.
Industrial Brownhoist Corp.

Manganese.
Electro Metallurgical Sales Corp.

Mechanical Draft Apparatus—(See Heating and Vent. App.).

Mechanical Stokers.
Standard Stoker Co.

Melters, Snow Electric.
Q & C Co. The.

Metallic Flexible Conduit.
General Electric Supply Corp.

Meters, Water & Oil.
Worthington Pump & Machinery Corp.

Milling Machines, Planer Type.
Sellers & Co., Inc., Wm.

Milling Machines, Plain and Universal.
Ryerson & Son, Joseph T.

Mohair Upholstery Velvets.
Chase & Co., L. C.
Massachusetts Mohair Plush Co.

Molybdenum Metal.
Vanadium Corp. of America.

Monel Metal, Rods, Sheets, Tubes, Wire, etc.
International Nickel Co., The.

Monorail Switches & Turntables.
Yale & Towne Mfg. Co.

Motors, Electric.
Fairbanks-Morse & Co.
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.

Motors & Generators.
Fairbanks-Morse & Co.

Moulding.
Aluminum Co. of America.

Movers, Locomotive.
Whiting Corporation.

Nails.
American Steel & Wire Co.
Interstate Iron & Steel Co.
Reading Iron Co.
Ryerson & Son, Joseph T.

Nipples, Air Hose.
Prime Manufacturing Co.

Nozzles, Exhaust.
Franklin Railway Supply Co., Inc.

Nuts—(See Bolts and Nuts).

Nut Locks.
Grip Nut Co.
National Lock Washer Co.
National Railway Appliance Co.
Reliance Mfg. Company.

Nuts, Tank Hose.
Prime Manufacturing Co., The.

Oil-Electric Locomotives.
American Locomotive Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Oil, Linseed,
National Lead Co.

Oil Plugs, Steam Chest.
Franklin Railway Supply Co., Inc.

Oil Renovation.
Railway Service & Supply Corp.

Packing, Air Pump.
Johns-Manville Corp.
Pilot Packing Co.
Union Asbestos & Rubber Co.
Westinghouse Air Brake Co.

Packing, Cylinder and Valve Ring.
Hunt-Spiller Mfg. Corp.
Westinghouse Air Brake Co.

Packing, Locomotive.
Johns-Manville Corp.

Packing, Locomotive Cab Cock.
Johns-Manville Corp.
Union Asbestos & Rubber Co.

Packing Renovation.
Railway Service & Supply Corp.

Packing, Ring Boiler.
Union Asbestos & Rubber Co.

Packing, Semi-Metallic.
Pilot Packing Co.
Central Alloy Steel Corp.

Packing, Sheet.
Johns-Manville Corp.
Union Asbestos & Rubber Co.

Packing, Soft.
Carey Co., Philip, The.
Johns-Manville Corp.
Pilot Packing Co.
Union Asbestos & Rubber Co.

Packing, Throttle.
Johns-Manville Corp.
Union Asbestos & Rubber Co.

Packing.
Westinghouse Air Brake Co

Paint, Front End.
Berry Bros.

Paint, Metal Protective.
National Lead Co.
National Railway Appliance Co.
Sherwin-Williams Co.

Paint, Powder.
Aluminum Co. of America

Paints.
du Pont de Nemours & Co., Inc., E. I.
National Lead Co.
National Railway Appliance Co.
Sherwin-Williams Co.

Paper, Car Liners—(See Car Liners, Paper).

Paper, Sheathing.
Carey Co., Philip, The.

Pavement Breakers.
Ingersoll-Rand Co.

Pickling Equipment, Monel Metal.
International Nickel Co., The.

Pile Drivers.
American Hoist & Derrick Co.
Industrial Brownhoist Corp
Orton Crane & Shovel Co.

Piling, Creosoted.
American Creosoting Co.
Century Wood Preserving Co.
International Creosoting & Construction Co.
Jennison-Wright Co.
National Lumber & Creosoting Co.

Piling, Sheet Steel.
American Bridge Co.
Carnegie Steel Co.

Pilot Beams, Cast Steel.
General Steel Castings Corp.—(Commonwealth Division).
Gould Coupler Co. The.
Scullin Steel Co.

Pilots, Cast Steel.
General Steel Castings Corp.—(Commonwealth Division).

Pins, Airbrake.
Champion Rivet Co.
Steel Car Forge Company.

Pins, Center.
Miner, W. H.

Pins, Coupler Knuckle.
Champion Rivet Co.
McConway & Torley Co.
National Malleable & Steel Castings Co.

Pins, Crank.
American Locomotive Co.
Baldwin Locomotive Works.
Miner, Inc., W. H.
Union Asbestos & Rubber Corp.

Pipe, Cast Iron.
American Radiator Co.

Pipe, Chrome Alloy.
Babcock & Wilcox Tube Co.

Pipe Coverings.
Carey Co., Philip, The.
Johns-Manville Corp.

Pipe Fittings—(See Fittings, Pipe).

Pipe, Metal Culvert.
American Rolling Mill Co.
American Sheet & Tin Plate Co.

Pipe, Seamless Iron.
Babcock & Wilcox Tube Co.

Pipe, Seamless Steel.
Babcock & Wilcox Tube Co.

Pipe, Steel Signal.
National Tube Co.

Pipe, Wrought Iron.
Reading Iron Co.

Pits, Drop Pit Tables.
Whiting Corporation.

Planers, Plate.
Ryerson & Son, Jos. T.
Sellers & Co., Inc., Wm.

Plaster Base.
Celotex Company, The.

Plates.
Alan Wood Steel Co.
Steel Car Forge Co.

Plates, Follower.
Steel Car Forge Co.

Plates, Boiler, Firebox—(See Steel Firebox).

Plates, Center — (See Bearings, Center).

Plates, Iron & Steel.
Alan Wood Steel Co.
American Rolling Mill Co., The.
Carnegie Steel Co.
Illinois Steel Co.
Inland Steel Co.
Interstate Iron & Steel Co.
Ryerson & Son, Joseph T.

Plates, Tie.
Illinois Steel Co.
Inland Steel Company.
Interstate Iron & Steel Co.
Railroad Supply Co.
Scullin Steel Co.
Tennessee Coal, Iron & Railroad Co.

Plates, Tin and Terne.
American Sheet & Tin Plate Co.

Platforms, Car.
Alan Wood Steel Co.
General Steel Castings Corp.—(Commonwealth Division).
Gould Coupler Co., The.
Standard Coupler Co.

Plows, Railroad and Grading.
Western Wheeled Scraper Co.

Plows, Snow.
American Locomotive Co.
Brill Co., The J. G.
Clark Tructractor Co.
Jordan Co., O. F.
National Railway Appliance Co.
Q & C Co., The.

Plugs, Arch Tube.
Prime Mfg. Co., The.

Plugs, Oil & Grease Cup.
Prime Mfg. Co., The.

Plugs, Washout.
Prime Mfg. Co., The.

Plumbing Fixtures, Enameled, China, Brass.
Kohler Company.
Standard Sanitary Mfg. Co.

Plush, Mohair.
Chase & Co., L. C.
Massachusetts Mohair Plush Co.

Pneumatic Tools.
Ingersoll-Rand Co.

Poles.
Central Coal & Coke Co
General Electric Supply Corp.
Graybar Electric Co.

Poles, Creosoted.
American Creosoting Co.
Central Coal & Coke Co.
Century Wood Preserving Co.
Graybar Electric Co.
International Creosoting & Construction Co.
National Lumber & Creosoting Co.

Poles, Signal.
General Railway Signal Co.
Union Switch & Signal Co.
Whiting Corporation.

Poles, Steel Tubular.
Graybar Electric Co.
National Tube Co.

Poles, Zinc Metal Arsenite Treatment.
Curtin-Howe Corp.
Eppinger & Russell Co.

Posts, Fence.
Curtin-Howe Corp.
Eppinger & Russell Co.
National Lumber & Creosoting Co.

Posts, Fence, Creosoted.
Inland Steel Co.
International Creosoting & Construction Co.
National Lumber & Creosoting Co.

Posts, Steel Fence.
American Steel & Wire Co.
Q & C Co., The.

Powder, Blasting—(See Explosives).

Powdered Coal Equipment.
Muhlfeld, John E.

Power Transmission Supplies
Sellers & Co., Inc., Wm.

Power Plants.
General Electric Co.
Kohler Company.
Muhlfeld, John E.
Stone & Webster Engineering Corp.
United Engineers & Constructors, Inc.
Westinghouse Elec. & Mfg Co.

Power Shovels.
American Hoist & Derrick Co.
Northwest Engineering Co.

Power Transmission Supplies.
Sellers & Co., Inc., Wm.

Wrought Iron Co. of America.

Preservatives, Wood.
Century Wood Preserving Co.
Jennison-Wright Co.
Michigan Wood Preserving Co.
New England Wood Preserving Co.
Ohio Wood Preserving Co
Pittsburgh Wood Preserving Co.

Presses, Flanging Hydraulic.
Birdsboro Steel Foundry & Mach. Co.

Presses, Hydraulic.
Birdsboro Steel Foundry & Mach. Co.

Presses, Wheel.
Birdsboro Steel Foundry & Mach. Co.
Sellers & Co., Inc., Wm.

Pulverizers, Coal — (See Crushers, Coal).

Pullers, Car Electric.
Whiting Corporation.

Pullshovels.
American Hoist & Derrick Co.
Northwest Engineering Co.
Whiting Corporation.

Pulverized Coal Burning Systems.
Whiting Corporation.

Pumping Stations.
Fairbanks-Morse & Co.

Pump Liners, Monel Metal.
International Nickel Co. The.

Pump Rods, Monel Metal.
International Nickel Co., The.

Pump Shafts, Monel Metal.
International Nickel Co., The.

Pumps, Hydraulic.
Ingersoll-Rand Co.
Pumps & Pumping Machinery.
Fairbanks-Morse & Co.
Ingersoll-Rand Co.
Westinghouse Air Brake Co
Worthington Pump & Machinery Corp.
Pumps, Vacuum.
Ingersoll-Rand Co.
Punching and Shearing Machines.
Ryerson & Son, Joseph T
Pushers, Coal.
Standard Stoker Co.
Pyrometers, Superheated Steam.
Superheater Co., The.
Radiators.
American Radiator Co.
Rail Anchors.
Bethlehem Steel Co.
P & M Company, The.
Rail-Bonds.
American Steel & Wire Co.
General Electric Co.
General Railway Signal Co.
Graybar Electric Co.
Railroad Supply Co.
Union Switch & Signal Co.
Westinghouse Elec. & Mfg. Co.
Rail Braces — (See Braces, Rail).
Rail Cranes.
American Hoist & Derrick Co.
Rail, Manganese.
Manganese Steel Rail Co.
Rail Reclamation Equipment.
Ryerson & Son, Joseph T.
Railroad Shops.
United Engineers & Constructors, Inc.
Rail Splice Plates — (See Joints, Rail).
Railroad Structures — (See Engineers and Contractors; also Building).
Rolls.
Bethlehem Steel Co.
Carnegie Steel Co.
Hyman-Michaels Co.
Illinois Steel Co.
Inland Steel Co.
Tennessee Coal, Iron & Railroad Co.
Thomson Rail Corp.
Rails, Relaying.
Hyman-Michaels Co.
Railway Signals.
General Electric Supply Corp.
Rattan.
Hale-Kilburn Co.
Heywood-Wakefield Co.
Receivers, Air.
Ingersoll-Rand Co.
Westinghouse Air Brake Co
Recorders, Speed & Cut-off
Valve Pilot Co.
Rectifiers for Signal Work.
General Electric Co.
Railroad Supply Co.
Union Switch & Signal Co.
Reducing Valves.
Vapor Car Heating Co., Inc.
Reels, Hose.
National Railway Appliance Co.
Refrigeration Equipment.
American Radiator Co.
Reflectors, Headlight.
Sunbeam Electric Mfg. Co.
Refrigerator Car Insulation.
Celotex Company, The.
Refrigerators.
American Radiator Co.
Wine Railway Appliance Co.
Regulators, Heat.
American Radiator Co.
Relays.
General Railway Signal Co.
Railroad Supply Co.
Union Switch & Signal Co.
Westinghouse Elec. & Mfg. Co.
Removers, Paint & Varnish.
Oakite Products, Inc.
Renovated Oil & Waste.
Railway Service & Supply Corp.
Renovated Packing.
Railway Service & Supply Corp.
Repair Parts, Stoker.
Standard Stoker Co.
Replacers, Car.
National Railway Appliance Co.
Q & C Company, The.
Reverse Gear, Power.
Barco Mfg. Co.
Franklin Railway Supply Co., Inc.
Rivet Cutters.
Ingersoll-Rand Co.
Interstate Iron & Steel Co.
Riveters, Hydraulic.
Birdsboro Steel Foundry & Mach. Co.
Riveting Machines.
Ingersoll-Rand Co.
Rivets.
Champion Rivet Co.
Inland Steel Co.
Interstate Iron & Steel Co.
Neely Nut & Bolt Co.
Ryerson & Son, Joseph T.
Pressed Steel Car Co.
Russell, Burdsall & Ward Bolt and Nut Co.
Rods.
Neely Nut & Bolt Co.
Wrought Iron Co. of America.
Rolled Steel.
Carnegie Steel Co.
Scullin Steel Co.
Roller Bearings—(See Bearings, Roller).
Rolls, Bending & Straightening.
Birdsboro Steel Foundry & Mach. Co.
Sheet Steel Trade Extension Committee.
Roof Decks, Steel.
Mahon Co., R. C.
Sheet Steel Trade Extension Committee.
Roof Slabs, Concrete.
American Cement Tile Mfg. Co.
Federal Cement Tile Co.
Roofing, Asbestos.
Carey Co., Philip, The.
Johns-Manville Corp.
Roofing, Buildings.
American Rolling Mill Co.
Carey & Co., Philip.
Johns-Manville Corp.
Roofing, Car.
American Rolling Mill Co.
American Sheet & Tin Plate Co.
Carey Co., Philip, The.
Hutchins Car Rfg. Co.
Johns-Manville Corp.
National Railway Appliance Co.
Tuco Products Corp.
Union Metal Products Co.
Roofing, Corrugated.
American Rolling Mill Co.
American Sheet & Tin Plate Co.
Carey Co., Philip, The.
Johns-Manville Corp.
Roofing, Insulation.
Celotex Company, The.
Roofing, Building.
Carey Co., Philip, The.
Roofing, Tile.
American Cement Tile Mfg. Co.
Federal Cement Tile Co.
Roofing, Tile, Cement.
American Cement Tile Mfg. Co.
Federal Cement Tile Co.
Roofing, Tin.
American Sheet & Tin Plate Co.
Roofing, Wood.
Industrial Lumber Co.
Rope, Wire — (See Wire Rope).
Rounds, Squares, Flat and Deformed Reinforcing.
Scullin Co.
Rust Preventatives.
Berry Bros.
Dearborn Chemical Co.
Oakite Products, Inc.
Safe Ends.
National Tube Co.
Sand Drying Plants.
Roberts & Schaefer Co.
Sand Plants.
Railway Engineering Equipment Co.
Sanitary Products.
West Disinfecting Co.
Sash Balances
Tuco Products Co.
Saws, Circular Metal.
Ryerson & Son, Joseph T.
Saws, High Speed, Friction.
Ryerson & Son, Joseph T.
Saws, Portable Rail.
Industrial Brownhoist Corp
Q & C Co., The.
Scales.
Fairbanks-Morse & Co.
Scrapers, Wheeled and Drag.
Western Wheeled Scraper Co.
Screens, Passenger Car.
Tuco Products Corp.
Seats, Car.
Brill Co., The J. G.
Hale-Kilburn Co.
Heywood-Wakefield Co.
St. Louis Car Co.
Seats, Coach.
Brill Co., The J. G.
Shafting.
Falls Hollow Staybolt Co.
Ryerson & Son, Joseph T.
Sellers & Co., Inc., Wm.
Shapers.
Ryerson & Son, Joseph T.
Shapes, Pressed Steel.
Pressed Steel Car Co.
Sellers & Co., Inc., Wm.
Shapes, Structural.
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Co.
Inland Steel Co.
Interstate Iron & Steel Co.
Ryerson & Son, Joseph T.
Scullin Steel Co.
Sheathing.
Celotex Company, The.
Sheds, Train.
American Bridge Co.
Inland Steel Co.
Sheets, Alloy.
Alan Wood Steel Co.
Sheets, Black and Galvanized.
Allegheny Steel Co.
American Rolling Mill Co., The.
American Sheet & Tin Plate Co.
Central Alloy Steel Corp.
Inland Steel Co.
Ryerson & Son, Joseph T.
Sheets, Blue Annealed.
Allegheny Steel Co.
Alan Wood Steel Co.
Sheets, Car & Building.
American Rolling Mill Co.
Sheets, Copper Bearing.
Alan Wood Steel Co.
Sheets, Corrugated.
American Rolling Mill Co., The.
American Sheet & Tin Plate Co.
Carnegie Steel Co.
Johns-Manville Corp.
Ryerson & Son, Joseph T.
Sheets, Corrugated and Plain.
Inland Steel Co.
Ryerson & Son, Joseph T.
Sheets, Electrical.
American Rolling Mill Co., The.
American Sheet & Tin Plate Co.
Central Alloy Steel Corp.
Ryerson & Son, Joseph T.
Sheets, Iron & Steel.
American Rolling Mill Co.
Bethlehem Steel Co.
Sheets, Locomotive Jacket.
American Rolling Mill Co., The.
American Sheet & Tin Plate Co.
Inland Steel Co.
Sheets, Polished or Planished Iron.
American Rolling Mill Co., The
American Sheet & Tin Plate Co.
Sheets, Steel.
Alan Wood Steel Co.
American Rolling Mill Co. The.
Inland Steel Co.
Ryerson & Son, Joseph T.
Shelving, Steel.
Sheet Steel Trade Extension Committee.
Sherardising Plants.
General Electric Co.
Shop Calling Systems—(See Systems, Communication)
Shops, Railroad—(See Buildings, Iron, Steel and Steel Concrete).
Shovels & Draglines.
American Hoist & Derrick Co.
Industrial Brownhoist Corp.
Shovels, Gasoline & Electric.
American Hoist & Derrick Co.
Northwest Engineering Co.
Shovels, Steam, Gasoline & Electric.
American Hoist & Derrick Co.
Clark Tructractor Co.
Orton Crane & Shovel Co.
Siding, Bldg., Car, Corrugated & Plain
Kinnear Mfg. Co.
American Rolling Mill Co., American Sheet & Tin Plate Co.
Inland Steel Co.
Siding, Corrugated & Plain.
Johns-Manville Corp.
Siding, Iron & Steel.
American Rolling Mill Co.
Carey Co., Philip, The.
Signal Accessories.
Electric Storage Battery Co.
General Electric Co.
General Railway Signal Co.
Graybar Electric Co.
Railroad Supply Co.
Union Switch & Signal Co.
Westinghouse Elec. & Mfg. Co.
Signals, Automatic Cab.
General Railway Signal Co.
Union Switch & Signal Co.
Signal Blades.
General Railway Signal Co.
Union Switch & Signal Co.
Signals, Crossing.
Union Switch & Signal Co.
Signals, Crossing Protection.
General Railway Signal Co.
Railroad Supply Co.
Signals, Railway.
General Electric Co.
Union Switch & Signal Co.
Signs, Highway Crossing.
Railroad Supply Co.
Silico Manganese.
Vanadium Corp. of America.
Silicon.
Electro Metallurgical Sales Corp.
Slabs, Concrete Floor.
American Cement Tile Mfg. Co.
Federal Cement Tile Co.
Slag, Blast Furnace.
Carnegie Steel Co.
Slotting Machines.
Sellers & Co., Inc., Wm.
Slotting Machines, Locomotive Cylinder.
American Steel & Wire Co.
Soap, Liquid.
West Disinfecting Co.
Solder.
National Bearing Metals Corp.
Westinghouse Elec. & Mfg. Co.
Special Machinery.
Whiting Corporation
Speed Indicators & Recorders
Valve Pilot Corp.
Spelter—(See Zinc).
Spikes.
American Steel & Wire Co.
Bethlehem Steel Co.
Illinois Steel Co.
Inland Steel Co.
Ryerson & Son, Joseph T.
Scullin Steel Co.
Splice Bars, Angle.
Carnegie Steel Co.
Illinois Steel Co.
Inland Steel Co.
Spreaders, Ballast.
Jordan Co., O. F.
Spring Plates or Seats.
Allegheny Steel Co.
National Malleable & Steel Castings Co.
Union Spring & Mfg. Co.
Springs.
American Steel Foundries Co.
American Steel & Wire Co.
National Railway Appliance Co.
Railway Steel Spring Co.
Standard Steel Works Co.
Union Spring & Mfg. Co.
Union Switch & Signal Co.
Springs, Shop Equipment.
Ryerson & Son, Joseph T
Springs, Vanadium Steel.
National Railway Appliance Co.
Railway Steel Spring Co.
Union Spring & Mfg. Co.
Stacks, Steel.
American Bridge Co.
Stands, Switch & Target.
Q & C Co., The.
Staybolts.
American Locomotive Co.
Ewald Iron Co.
Falls Hollow Staybolt Co.
Flannery Bolt Co.
Ryerson & Son, Joseph T
Wrought Iron Co. of America.
Staybolts, Hollow.
Falls Hollow Staybolt Co
Ryerson & Son, Joseph T
Steam Chests.
Franklin Railway Supply Co., Inc.
Steam Enclosures, Corrugated Iron.
Central Alloy Steel Corp.
Steam Shovels.
American Hoist & Derrick Co.
Northwest Engineering Co.
Orton Crane & Shovel Co.
Steel Alloy.
Alan Wood Steel Co.
Interstate Iron & Steel Co.
Ryerson & Son, Inc., Jos. T.
Steel, Firebox.
Alan Wood Steel Co.
Carnegie Steel Co.
Illinois Steel Co.
Steel, Heat Treated.
Interstate Iron & Steel Co.
Oliver Iron & Steel Corp.
Steel & Iron, Stainless.
Allegheny Steel Co.
Steel, Open Hearth.
Alan Wood Steel Co.
Carnegie Steel Co.
Interstate Iron & Steel Co.
Steel, Pressed Specialties.
Hale-Kilburn Co.
Steel, Special Deep Drawing.
Alan Wood Steel Co.
Steel, Structural.
American Bridge Co.
Carnegie Steel Co.
Illinois Steel Co.
Inland Steel Co.
Ryerson & Son, Jos. T.
Scullin Steel Co.
Steel, Tool.
Illinois Steel Co.
Midvale Co., The.
Q & C Co., The.
Ryerson & Son, Joseph T.
Step Joints.
Q & C Co., The.
Rail Joint Co.
Steps, Car—(See Car Steps, Safety).
Stokers, Industrial.
Whiting Corporation.
Stokers, Locomotive.
Standard Stoker Co.
Stokers, Mechanical.
Westinghouse Elec. & Mfg. Co.
Stoker Repair Parts.
Standard Stoker Co.
Storm Sewers, Corrugated Iron.
Armco Culvert Mfrs. Assoc.
Central Alloy Steel Corp.
Strainer, Air.
Westinghouse Air Brake Co.
Strainers, Tank Hose.
Prime Mfg. Co., The.
Stream Enclosures, Corrugated Iron.
Armco Culvert Mfrs. Assoc.
Stringers, Bridge.
Central Coal & Coke Co.
Century Wood Preserving Co.
Industrial Lumber Co.
International Creosoting & Construction Co.
Stringers, Bridge, Creosoted.
Century Wood Preserving Co.
National Lumber & Creosoting Co.
Structural Shapes, Rolled Shapes.
Carnegie Steel Co.
Scullin Steel Co.
Superheaters.
Babcock & Wilcox Tube Co.
Superheater Co., The.
Supports, Bottom Rod Safety.
Chicago Railway Equipment Co.
Switch Boards.
Graybar Electric Co.
Johns-Manville Corp.
Westinghouse Elec. & Mfg. Co.
Switch Machines.
General Railway Signal Co
Switch Movements.
Union Switch & Signal Co.
Switch Ties.
International Creosoting & Construction Co.
Switch Ties, Creosoted.
National Lumber & Creosoting Co.
Switches, Electric.
Electric Service Supplies Co.
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.
Switches and Switch Stands.
Ramapo Ajax Corp.
Syphons, Corrugated Iron.
Armco Culvert Mfrs. Assoc.
Central Alloy Steel Corp.

Exchange Sawmill Sales Co.
Syphons, Locomotive.
Locomotive Firebox Co.
Tables, Drop Pit Electric.
Whiting Corporation.
Tables, Transfer.
Whiting Corporation.
Tacks.
Interstate Iron & Steel Co.
Tamping Machines, Tie.
Ingersoll-Rand Co.
Tamping Outfits, Tie.
Ingersoll-Rand Co.
Tanks, Air, Gas, Oil and Water.
American Bridge Co.
American Locomotive Co.
Babcock & Wilcox Tube Co.
National Tube Co.
Pressed Steel Car Co.
Westinghouse Air Brake Co.
Tanks, Water.
American Locomotive Co.
Tape, Insulation.
Johns-Manville Corp.
Okonite Co., The.
Westinghouse Elec. & Mfg. Co.
Taps, Staybolt.
Ryerson & Son, Joseph T.
Telephone Service, Long Distance.
American Telephone & Telegraph Co.
Tele. & Tele. Wire.
General Electric Supply Corp.
Terminals, Railroad.
United Engineers & Constructors, Inc.
Testers, Boiler.
Sellers & Co., Inc., Wm.
Testers, Gage.
Ashton Valve Co.
Testers, Staybolt.
Flannery Bolt Co.
Testing Machines, Drop.
Whiting Corporation.
Thermostats.
Gold Car Heating & Lighting Co.
Vapor Car Heating Co., Inc.
Throttles.
American Throttle Co.
Tie Plates.
Bethlehem Steel Co.
Railroad Supply Co.
Ties, Creosoted.
International Creosoting & Construction Co.
Jennison-Wright Co.
National Lumber & Creosoting Co.
Ties, Steel.
American Bridge Co.
Bethlehem Steel Co.
Carnegie Steel Co.
Ties, Wood.
Curtin-Howe Corp.
Eppinger & Russell Co.
International Creosoting & Construction Co.
Tile, Cement, Concrete.
American Cement Tile Mfg. Co.
Federal Cement Tile Co.
Timber.
Central Coal & Coke Co.
Curtin-Howe Corp.
Tires.
Firestone Tire & Rubber Co.
Fisk Tire Co., Inc.
Goodyear Tire & Rubber Co.
Goodrich Rubber Co., B. F.
Tools, High Speed Steel.
Bethlehem Steel Co.
Tractors.
Elwell-Parker Electric Co.
Ford Motor Co.
Eppinger & Russell Co.
Exchange Sawmill Sales Co.
Industrial Lumber Co.
International Creosoting & Construction Co.
West Coast Lumber Trade Extension Bureau.
Timber Creosoted.
Century Wood Preserving Co.
International Creosoting & Construction Co.
National Lumber & Creosoting Co.
Tires.
General Tire & Rubber Co.
Goodrich Rubber Co., B. F.
Goodyear Tire & Rubber Co., Inc.
Tires, Steel.
Edgewater Steel Co.
Midvale Co., The.
Railway Steel Spring Co.
Standard Steel Works Co.
Toilet Papers.
U. S. Envelope Co.
Tools, High Speed Steel.
Bird-Archer Co., The.
Towers, Floodlight.
Pyle-National Co.
Track, Overhead.
Whiting Corporation.
Track, Skates.
Q & C Co., The.
Tracks, Industrial.
Yale & Towne Mfg. Co.
Tractors.
Caterpillar Tractor Co.
Tractors, Industrial.
Clark Tructractor Co.
Elwell-Parker Electric Co.
International Harvester Co.
Tractors, Turntable.
Nichols & Bros., Geo. P.
Whiting Corporation.
Trailers.
Clark Tructractor Co.
Fruehauf Trailer Co.
Trailers, Four Wheel.
Fruehauf Trailer Co.
Trailers, Heavy Duty.
Fruehauf Trailer Co.
Trailers, Industrial.
Yale & Towne Mfg. Co.
Trailers, Pole.
Fruehauf Trailer Co.
Trailers, Semi.
Fruehauf Trailer Co.
Trailers, Truck.
Fruehauf Trailer Co.
Train Control Systems.
General Railway Signal Co.
Union Switch & Signal Co.
Tramrail System, Overhead.
Whiting Corporation.
Tramways, Wire Rope.
American Steel & Wire Co.
Transfer Tables.
American Bridge Co.
Industrial Brownhoist Corp.
Nichols & Bros., Geo. P.
Whiting Corporation.
Transformers
General Electric Supply Corp.
Railroad Supply Co.
Westinghouse Elec. & Mfg. Co.
Trap Doors & Fixtures.
Tuco Products Corp.
Traps, Steam.
Johns-Manville Corp.
Treads, Bridge Floor.
Alan Wood Steel Co.
Carnegie Steel Co.
Treads, Safety.
Ryerson & Son, Joseph T.
Treatment, Water—(See Water Softening and Purifying).
Trolleys, I-Beam.
Yale & Towne Mfg. Co.
Trolleys, Monorail.
Whiting Corporation.
Truck Frames—(See Frames, Truck).
Trucks, Car.
St. Louis Car Co.
Trucks, Car and Locomotive.
American Locomotive Co.
American Steel Foundries.
Baldwin Locomotive Works.
Bettendorf Company, The.
Birdsboro Steel Foundry & Mach. Co.
Brill Co., The J. G.
Franklin Railway Supply Co., Inc.
General Steel Castings Corp.—(Commonwealth Division).
Gould Coupler Co.
Mt. Vernon Car Mfg. Co.
National Railway Appliance Co.
Pressed Steel Car Co.
St. Louis Car Co.
Scullin Steel Co.
Standard Car Truck Co.
Symington Co., The.
Trucks, Dump.
Clark Tructractor Co.
Trucks, Electric Storage Battery.
Elwell-Parker Electric Co.
Whiting Corporation.
Trucks, Industrial.
Elwell-Parker Electric Co.
Trucks, Motor.
Autocar Co., The.
General Motors Truck Co.
International Harvester Co.
White Co., The.
Trucks, Shop.
Clark Tructractor Co.
Whiting Corporation.
Trucks, Tender.
General Steel Castings Corp.—(Commonwealth Division).
Trucks, Trailer.
Brill Co., The J. G.
General Steel Castings Corp.—(Commonwealth Division).
Franklin Railway Supply
Tubes, Arch.
National Tube Co.
Tubes, Boiler.
Allegheny Steel Co.
Babcock & Wilcox Tube Co.
Bethlehem Steel Co.
National Tube Co.
Ryerson & Son, Joseph T.
Tubes, Boiler, Charcoal, Iron.
Bethlehem Steel Co.
Reading Iron Co.
Tubes, Staybolt.
Falls Hollow Staybolt Co.
Tubes, Tire.
Firestone Tire & Rubber Co.
Goodrich Rubber Co., B. F.
Goodyear Tire & Rubber Co.
Tubing.
Aluminum Co. of America.
Tubing, Chrome Alloy.
Babcock & Wilcox Tube Co.
Tubing, Seamless Steel.
Babcock & Wilcox Tube Co.
National Tube Co.
Tungsten Metal.
Vanadium Corp. of America
Turbo Generators.
Electric Service Supplies Co.
General Electric Co.
Pyle-National Co.
Sunbeam Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Turnbuckles.
American Bridge Co.
American Steel & Wire Co.
Ryerson & Son, Joseph T.
Turntable Tractors.
Nichols & Bro., Geo. P. Whiting Corporation.
Turntables.
American Bridge Co.
Industrial Brownhoist Corp.
Turntables, Overhead Track.
Whiting Corporation.
Turntables, Industrial.
Whiting Corporation.
Turntables, Motor Bus.
Whiting Corporation.
Uncoupling Device.
Hutchins Car Rfg. Co.
Undercrossings, Corrugated Iron.
Armco Culvert Mfrs. Assoc.
Central Alloy Steel Corp.
Underfloor Duct.
General Electric Supply Corp.
Underfloor Duct. Fibre and Metal.
Johns-Manville Corp.
Underframes, Steel.
Bettendorf Co., The.
Brill Co., The J. G.
Pressed Steel Car Co.
St. Louis Car Co.
Underframes, Cast Steel.
General Steel Castings Corp.—(Commonwealth Division).
Underground Conduit.
General Electric Supply Corp.
Upholstery, Car.
Brill Co., The J. G.
Chase & Co., L. C.
Massachusetts Mohair Plush Co.
Pantasote Co., Inc., The.
Valve Caps.
Schrader's Son, Inc., A.
Valve Gear, Locomotive.
Pyle-National Co.
Valves, Air Brake.
Westinghouse Air Brake Co.
Valves, Check & Angle Steam
Sellers & Co., Inc., Wm.
Valves, Drifting.
Ardco Mfg. Co.
Sellers & Co., Inc., Wm.
Valves, Hydraulic.
Birdsboro Steel Foundry & Mach. Co.
Valves, Piston.
Franklin Railway Supply Co., Inc.
Valves, Pop, Safety & Relief.
Ashton Valve Co.
Vapor Car Heating Co., Inc.
Valves, Pressure Regulating.
Gold Car Heating & Lighting Co.
Westinghouse Air Brake Co.
Valves, Tank Air.
Waugh Equipment Co.
Valves, Tire.
Schrader's Son, Inc., A.
Valves, Throttle.
Bradford Corporation.
Vanadium.
Electro Metallurgical Sales Corp.
Varnish Powder.
Aluminum Co. of America.
Varnishes.
Berry Bros.
du Pont de Nemours & Co., Inc., E. I.
General Electric Supply Corp.
National Railway Appliance Co.
Sherwin-Williams Co.
Ventilators, Car.
Gold Car Heating & Lighting Co.
National Railway Appliance Co.
Vapor Car Heating Co., Inc.
Wine Railway Appliance Co.
Ventilators, Shop & Roundhouse.
Johns-Manville Corp.
Wardrobes, Rolling and Disappearing Front — (See Lockers).
Washers.
National Malleable & Steel Castings Co.
Oliver Iron & Steel Corp.
Reliance Mfg. Co.
Ryerson & Son, Joseph T.
Wine Railway Appliance Co.
Wrought Iron Co. of America.
Washer, Automatic Locomotive.
Transportation Equipment Corp.
Washers, Boiler.
Sellers & Co., Inc., Wm.
Washers, Lock.
National Lock Washer Co.
Reliance Manufacturing Co., The
Washers, Railway Car.
Whiting Corporation.
Waste Renovation.
Railway Service & Supply Corp.
Water Alarms — (See Low Water Alarms).
Waterproofing Materials and Compounds.
Johns-Manville Corp.
Water Purifying Materials & Compounds.
Bird-Archer Co., The.
Dearborn Chemical Co.
Water Softening & Purifying.
Bird-Archer Co., The.
Dearborn Chemical Co.
Weather Stripping.
Tuco Products Corp.
Wedges, Automatic.
Franklin Railway Supply Co., Inc.
Wedges, Journal Box.
American Steel Foundries.
Gould Coupler Co.
National Malleable & Steel Castings Co.
Pressed Steel Car Co.
Steel Car Forge Company.
Symington Co., The.
Weed Killer.
Q and C Co., The.
Welding Equipment.
Clark Tructractor Co.
Welding Machines, Acetylene.
Ryerson & Son, Joseph T.
Westinghouse Elec. & Mfg. Co.
Welding Machines, Electric.
General Electric Co.
National Railway Appliance Co.
Ryerson & Son, Joseph T.
Welding Machines, Flue.
Ryerson & Son, Joseph T.
Welding Materials.
Oxweld Railroad Service Co.
Franklin Railway Supply Co., Inc.
Welding Process.
Oxweld Railroad Service Co.
Welding Rods.
American Steel & Wire Co.
General Electric Supply Corp.
Ryerson & Son, Joseph T.
Welding Supplies.
General Electric Co.
Welding and Cutting Apparatus—(See Cutting and Welding Apparatus).
Well Casings, Corrugated Iron.
Armco Culvert Mfrs. Assoc.
Central Alloy Steel Corp.
Wheel Centers, Driving.
American Locomotive Co.
American Steel Foundries.
Baldwin Locomotive Works.
Birdsboro Steel Foundry & Mach. Co.
Edgewater Steel Co.
Hunt-Spiller Mfg. Corp.
Scullin Steel Co.
Standard Steel Works Co.
Union Steel Casting Co.
Wheels, Car and Locomotive.
American Locomotive Co.
American Steel Foundries.
Baldwin Locomotive Works.
Bethlehem Steel Co.
Carnegie Steel Co.
Edgewater Steel Co.
Illinois Steel Co.
Mt. Vernon Car Mfg. Co.
Pressed Steel Car Co.
Railway Steel Spring Co.
Standard Steel Works Co.
Wheels, Cast Iron, Chilled Tread.
Assn. of Mfrs. of Chilled Car Wheels.
Graybar Electric Co.
Griffin Wheel Co.
Mt. Vernon Car Mfg. Co.
Pressed Steel Car Co.
Wheels, Mine Car.
Carnegie Steel Co.
Edgewater Steel Co.
Mt. Vernon Car Mfg. Co.
Wheels, Passenger Car.
Carnegie Steel Co.
Edgewater Steel Co.
Pullman Car & Mfg. Corp.
Wheels, Steel and Steel Tired.
American Locomotive Co.
American Steel Foundries.
Carnegie Steel Co.
Edgewater Steel Co.
Illinois Steel Co.
Lima Locomotive Works.
Railway Steel Spring Co.
Standard Steel Works Co.
Wheels, Wrought Steel.
American Rolling Mill Co.
Bethlehem Steel Co.
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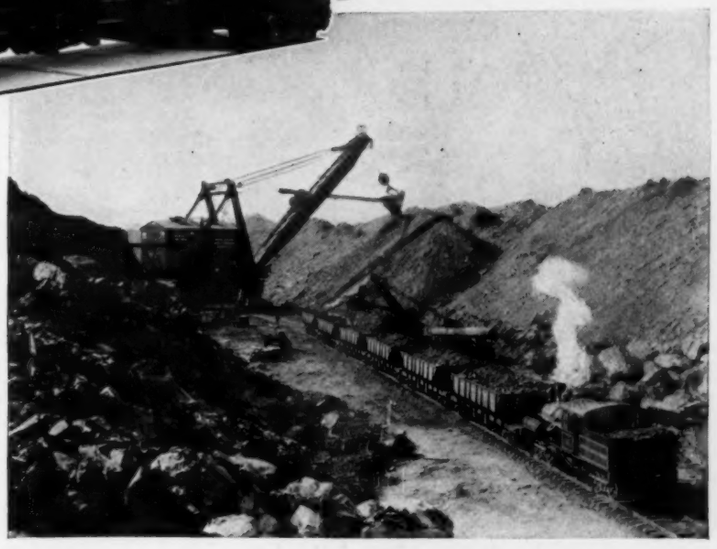

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